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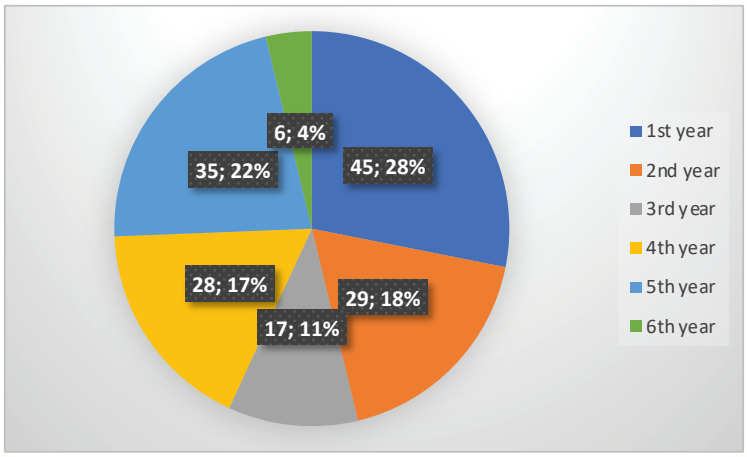
CURRENT THORACIC SURGERY



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Original Article

The role of ultrasonography in the diagnosis of rib fractures

Mustafa Kuzucuoğlu[1]*, İlkay Albayrak[2], Ali Cem Yekdeş[3], Arkın Acar[4], Ceyda Ceylan[1], Nihat Berk Sarmış[1], Emre Barış Şahin[5]

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ABSTRACT

Background: Background: Rib fractures rank among the most common conditions in thoracic traumas. Chest radiography is often insufficient for diagnosing rib fractures. Therefore, the study aimed to evaluate the success of thoracic ultrasonography (US) in diagnosing rib fractures.

Materials and Methods: Patients over 18 years of age who were hospitalized in our clinic due to trauma-related rib fractures between 2022 and 2023, were included. All patients had chest radiography and computed tomography (CT) scans during their emergency admission, as per the routine operation of the emergency department. Chest radiography and CT images were evaluated by the thoracic surgery clinic, and CT images were also examined through the radiology reports. Thoracic US was performed on all patients by the same radiologist the day after admission to the clinic. The patient's demographic characteristics, chest radiography, chest CT, and thoracic US findings were recorded, and the data were compared statistically.

Results: A total of 58 cases were included in the study, 42 (72.4%) males and 16 (27.6%) females. The mean age of the study population was 60.55 ± 15.71 years. When evaluated regarding trauma types, 42 (72.4%) patients had a fall, 15 (25.9%) had a traffic accident, and 1 (1.7%) patient had a history of battery. In addition to rib fractures, hemothorax was detected in 67.2% of the cases, pneumothorax in 27.6%, and pulmonary contusion in 19.0%. In radiological imaging, while 246 rib fractures were reported according to CT, 136 rib fractures were detected in USG and 140 in direct radiography. Considering CT imaging is the gold standard, 114 of 246 rib fractures (46.3%) could be detected with ultrasound imaging, while 127 (51.6%) were determined with direct radiography.

Conclusions: When chest CT is considered the gold standard, direct radiography, and thoracic US have no general superiority over each other.

Keywords: trauma, rib fracture, thoracic ultrasonography, direct radiography, diagnosis

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Introduction

Trauma is the third most common cause of death among all deaths and the most common in people over the age of 40 [1]. A rib fracture is the most frequent skeletal system pathology in blunt thoracic trauma. It occurs in approximately 25% of blunt thoracic traumas [2,3]. The most commonly used diagnostic methods for diagnosing rib fractures are physical examination and chest radiography; approximately 49% of rib fractures can be detected with these methods. Nevertheless, fractures, especially those occurring in the costal cartilage, cannot be determined by chest radiography [2-4]. This situation causes some rib fracture diagnoses to be overlooked with direct radiography.

In thoracic traumas, computed tomography (CT) is a superior examination compared to plain radiography in evaluating chest wall pathologies [5]. This approach allows for revealing almost all trauma-related conditions with detailed images. However, in trauma patients, CT is an appropriate examination only for hemodynamically stable patients, as the patient is separated from the trauma team during the imaging [6]. In addition, there are disadvantages, such as high radiation intake for pregnant patients and high cost [5]. Thus, thoracic ultrasonography (US) is sometimes used as an alternative to chest CT [7]. Although ultrasonography is not widely used to diagnose traumatic rib fractures, various studies have been conducted in the literature [2,3,8,9].

This study aimed to determine the effectiveness of ultrasonography in diagnosing rib fractures by comparing chest CT, thoracic US, and plain radiography results in trauma patients.

Materials and Methods

Patients over the age of 18 who were hospitalized in our clinic due to trauma-related rib fractures between October 20, 2022, and July 01, 2023, were included in the study. All patients included in the study had chest radiography and chest computed tomography (CT) during their emergency admission, as per the routine operation of our emergency department. Chest radiography and CT images were evaluated by the thoracic surgery clinic, and CT was also assessed through the radiology reports. Thoracic US was performed on all patients by the same radiologist the day after admission to the clinic. The radiologist was not informed about the patient's clinic or other imaging findings. The patients' demographic information, chest radiography, CT, and thoracic US findings were recorded, and the data obtained was compared statistically. Our study was conducted with decision number 2019/45 of Balıkesir University Clinical Research Ethics Committee.

Statistical Analyses

The data obtained were analyzed statistically using the SPSS program (Statistical Package for the Social Sciences Version 22.0; SPSS Inc. Chicago, IL, USA). Categorical data were presented as numbers (n) and percentages (%), and continuous data as mean ± standard deviation (SD) values. Sensitivity, specificity, negative predictive value, positive predictive value, and accuracy calculations were calculated with 95% confidence intervals using the MedCalc program (MedCalc Software Ltd- version 20.015).

Results

A total of 58 cases were included in the study, 42 of which (72.4%) were male and 16 (27.6%) were female. The mean age of the cases was 60.55 ± 15.71 years. When the symptoms were examined, it was observed that 51 patients (87.9%) had only chest pain complaints, while 7 (12.1%) had chest pain with shortness of breath. When evaluated regarding trauma types, 42 (72.4%) patients had a fall, 15 (25.9%) had a traffic accident, and 1 (1.7%) patient had a battery history. In addition to rib fractures, hemothorax was detected in 67.2% of the cases, pneumothorax in 27.6%, and pulmonary contusion in 19.0%. The numbers and locations of rib fractures detected in the cases according to the data obtained from all three radiological examinations are presented in Figure 1.

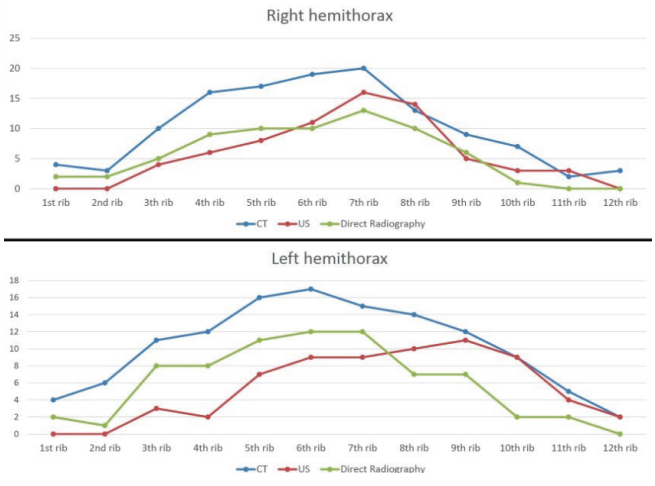

Figure 1. Numbers and locations of rib fractures detected by radiological imaging methods.

In radiological imaging, while 246 rib fractures were reported according to CT, 136 rib fractures were detected in USG and 140 in direct radiography. Considering CT imaging is the gold standard, 114 of 246 rib fractures (46.3%) could be detected with ultrasound imaging, while 127 (51.6%) were determined with direct radiography. Of the 246 rib fractures, 123 (50.0%) were observed in the right hemithorax and 123 (50%) in the left hemithorax. The distribution and relationship analysis of rib fractures detected by USG and direct radiography according to CT results are summarized in Tables 1 and 2.

The evaluations revealed that the first and second rib fractures in both the right and left hemithorax could not be visualized with thoracic US. It was observed that chest CT detected significantly more rib fractures, especially between the 4th and 9th ribs, where traumatic rib fractures are most common. We determined that direct radiography and thoracic US could detect fewer rib fractures than CT, but they did not have a significant advantage over each other.

Considering chest CT as the gold standard in diagnosing rib fractures, the sensitivity of thoracic US was 46.34%, while the sensitivity of direct radiography was 51.63%. The specificity was determined to be 31.25% for thoracic US and 59.38% for direct radiography. Rib fractures were further grouped according to their locations as anterior, posterior, and lateral, and validity analyses of US and direct radiography were performed by excluding cases with multiple localizations from the analysis (Table 3).

Table 1. Distribution of rib fractures detected on US and direct radiography compared to CT results.

		Rib fractures according to fracture location					
		All cases		Right hemithorax		Left hemithorax	
		CT (+)	CT (-)	CT (+)	CT (-)	CT (+)	CT (-)
US	(+)	114 (46.3%)	22 (68.8%)	55 (44.7%)	15 (68.2%)	59 (48.0%)	7 (77.8%)
	(-)	132 (53.7%)	10 (31.3%)	68 (55.3%)	7 (31.8%)	64 (52.0%)	2 (22.2%)
Direct radiography	(+)	127 (51.6%)	13 (40.6%)	57 (46.3%)	11 (50.0%)	70 (56.9%)	2 (22.2%)
	(-)	119 (48.4%)	19 (59.4%)	66 (53.7%)	11 (50.0%)	53 (43.1%)	7 (77.8%)

Table 2. Validity analysis of US and direct radiography according to CT results.

		Fracture location		
		All cases % (95% CI)	Right hemithorax % (95% CI)	Left hemithorax % 95% CI)
US	Sensitivity	46.34 (39.98-52.79)	44.72 (35.75-53.94)	47.97 (38.88-57.16)
	Specificity	31.25 (16.12-50.01)	31.82 (13.86-54.87)	22.22 (2.81(60.01)
	Negative predictive value	7.04 (4.28-11.37)	9.33 (5.19-16.22)	3.03 (0.90-9.69)
	Positive predictive value	83.82 (79.83-87.15)	78.57 (72.17-83.83)	89.39 (85.03-92.60)
	Accuracy	44.60 (38.67-50.66)	42.76 (34.59-51.23)	46.21 (37.50-55.10)
Direct radiography	Sensitivity	51.63 (45.19-58.02)	46.34 (37.31-55.56)	56.91 (47.68-65.80)
	Specificity	59.38 (40.64-76.30)	50.0 (28.22-71.78)	77.78 (39.99-97.19)

Table 3. Validity analysis of US and direct radiography according to fracture location.

		Fracture location		
		Anterior % (95% CI)	Posterior % (95% CI)	Lateral % (95% CI)
US	Sensitivity	39.47 (24.04-56.61)	44.62 (35.90-53.58)	57.58 (39.22-74.52)
	Specificity	0.0 (0.0-60.24)	27.27 (10.73-50.22)	0.0 (0.0-97.50)
	Negative predictive value	0.0 (0.0-0.0)	7.69 (3.98-14.37)	0.0 (0.0-0.0)
	Positive predictive value	78.95 (71.67-84.75)	78.38 (72.48-83.31)	95.0 (93.41-96.22)
	Accuracy	35.71 (21.55-51.97)	42.11 (34.15-50.37)	55.88 (37.89-72.81)
Direct radiography	Sensitivity	47.37 (30.98-64.18)	57.69 (48.72-66.30)	48.48 (30.80-66.46)
	Specificity	100.0 (39.76-100.0)	54.55 (32.21-75.61)	100.0 (2.50-100.0)
	Negative predictive value	16.67 (12.89-21.29)	17.91 (12.42-25.14)	5.56 (4.05-7.75)
	Positive predictive value	100.0 (0.0-100.0)	88.24 (82.26-92.38)	100.0 (0.0-100.0)
	Accuracy	52.38 (36.42-68.00)	57.24 (48.97-65.22)	50.0 (32.43-67.57)

Discussion

One of the most common pathologies in blunt thoracic trauma is rib fractures. The imaging methods commonly used in our country to diagnose rib fractures are direct radiography and chest CT. The literature review has revealed that thoracic direct radiography is the first imaging choice in cases of blunt chest trauma, and it is recommended by the American College of Surgeons Committee (ACSC) [10,11]. Przerwa et al have reported in their study that chest CT is superior to radiography in revealing injuries due to chest trauma [1]. In this study, they made changes in treatment management after chest CT in 83% of the patients. Jin et al also demonstrated in their study that low-dose CT imaging was satisfactorily successful in the diagnosis of rib fractures [12]. While chest radiography and CT are primarily used as imaging in the approach to trauma patients, bedside US imaging may be required in pregnant patients, unstable patients who cannot be transferred to the imaging unit, and patients with mental problems who cannot lie still during imaging. The authors planned the present study based on this idea.

In their study, Schellenberg et al [10] determined the chest CT method as the gold standard method to compare imaging methods in evaluating thoracic traumas. In our study, we also considered the chest CT method as the gold standard method when determining the effectiveness of US in the diagnosis of rib fractures. However, there were also rib fractures that we observed on US or radiography that could not be determined on CT. Sano et al compared chest CT and radiography in their study. In their study of 75 patients, they were able to detect the same rib fractures in 56% of the patients with both chest CT and radiography. Of the 217 rib fractures detected in their study, they could not observe rib fractures in 43 patients with chest radiography and in 21 with chest CT [13].

Turk et al evaluated 20 patients with blunt chest trauma with thoracic US who were symptomatic, but no pathology was determined on chest radiography [3]. In 18 of these patients, 26 rib fractures were detected, and thoracic US was demonstrated to be more sensitive than radiography. In their review, Battle et al stated that the thoracic US was more sensitive than chest radiography in diagnosing rib fractures, but there was a risk of bias in the studies included [14]. Similarly, a meta-analysis published by Yousefifard et al concluded that thoracic US was superior to chest radiography in diagnosing rib fractures, particularly if the US was performed by a radiologist [15]. The study performed by Hwang and Lee emphasized that the thoracic US was an effective method in diagnosing rib fractures, but the results obtained were insufficient to indicate that it was a more effective examination compared to direct radiography [16]. Pishbin et al performed thoracic US and chest radiography on 61 blunt thoracic trauma patients and detected a total of 59 rib fractures in 38 of these patients [2]. While they detected 58 of 59 rib fractures in 38 patients with thoracic US, they could not observe a rib fracture behind the scapula. However, they were able to detect 32 rib fractures in only 20 patients out of 59 rib fractures with chest radiography. In their study, thoracic US specificity was 100%, and sensitivity was 98.31%, while chest radiography had a specificity of 100% and sensitivity of 40.68%. Since chest CT was not used in the evaluation, their specificity and sensitivity rates were relatively high. In our study, since chest CT was used and considered this imaging method the gold standard, we determined the specificity of US to be 31.25%, its sensitivity to be 46.34%, and the specificity of radiography to be 59.38%, and sensitivity to 51.63%. In this study, unlike others, the effectiveness of thoracic US was demonstrated to be lower than radiography. We believe that the most crucial reason for this result was that the use of US in thoracic trauma and rib fracture is not commonly accepted by radiologists and their reluctance towards the procedure.

The most critical limitation of our study was convincing the radiologists to study the role of US in rib fractures. Since trauma patients are evaluated with chest radiography and CT in routine practice, thoracic US was not willingly performed by the radiology clinic. The study could be conducted with only one radiology doctor who was persuaded to participate. This condition caused the number of patients included in our study to be limited.

In conclusion, the present study indicated that chest CT was much superior to direct radiography and thoracic USG in diagnosing rib fractures. When chest CT is considered the gold standard, direct radiography, and thoracic US have no general superiority over each other. Thus, considering the conditions of our country, although radiography is still the first choice due to its easy accessibility, thoracic US can also be used in special patients or conditions.

Declaration of conflicting interests

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Ethics approval

The study was approved by of Balıkesir University Clinical Research Ethics Committee. (Date/Number: 2019/45)

Authors' Contribution

MK; designing the study, collection of data, interpreting the analyzed data, reviewing the literature, writing and editing of the study, İA; design of the study, ACY; analyzing the data, interpreting the analyzed data, reviewing the literature, writing the study, AA; Writing and editing of the study, CC, NBS, EBŞ; collection of data. All authors read and approved the final manuscript.

References

1. Błasińska-Przerwa K, Pacho R, Bestry I. The application of MDCT in the diagnosis of chest trauma. Pneumonol Alergol Pol 2013; 81: 518-6.
2. Pishbin E, Ahmadi K, Foogardi M, Salehi M, Seilanian Toosi F, Rahimi-Movaghar V. Comparison of ultrasonography and radiography in diagnosis of rib fractures. Chin J Traumatol 2017; 20: 226-8.
3. Turk F, Kurt AB, Saglam S. Evaluation by ultrasound of traumatic rib fractures missed by radiography. Emerg Radiol 2010; 17: 473-7.
4. Crandall J, Kent R, Patrie J, Fertile J, Martin P. Rib fracture patterns and radiologic detection a restraint-based comparison. Annu Proc Assoc Adv Automot Med 2000; 44: 235-59.
5. Deunk J, Dekker HM, Brink M, van Vugt R, Edwards MJ, van Vugt AB. The value of indicated computed tomography scan of the chest and abdomen in addition to the conventional radiologic work-up for blunt trauma patients. J Trauma 2007; 63: 757-63.
6. Reuter M. Trauma of the chest. Eur Radiol 1996; 6: 707-16.
7. Weingrow D. Under what situations is ultrasound beneficial for the detection of rib fractures? Ann Emerg Med 2022; 79: 540-2.
8. Hurley ME, Keye GD, Hamilton S. Is ultrasound really helpful in the detection of rib fractures? Injury 2004; 35: 562-6.
9. Çelik A, Akoglu H, Omercikoglu S, Bugdaycı O, Karacabey S, Kabaroglu KA et al. The diagnostic accuracy of ultrasonography for the diagnosis of rib fractures in patients presenting to emergency department with blunt chest trauma. J Emerg Med 2021; 60: 90-7.
10. Schellenberg M, Inaba K, Bardes JM, Orozco N, Chen J, Park C et al. The combined utility of extended focused assessment with sonography for trauma and chest x-ray in blunt thoracic trauma. J Trauma Acute Care Surg 2018; 85: 113-7.
11. Trauma ACoSCo. Thoracic trauma. Advanced trauma life support (ATLS), 9th ed. Chicago: Hearthside Publishing Services; 2012.
12. Jin L, Ge X, Lu F, Sun Y, Li C, Gao P et al. Low-dose ct examination for rib fracture evaluation: A pilot study. Medicine 2018; 97: e11624.
13. Sano A. Rib radiography versus chest computed tomography in the diagnosis of rib fractures. Thorac Cardiovasc Surg 2018; 66: 693-6.
14. Battle C, Hayward S, Eggert S, Evans PA. Comparison of the use of lung ultrasound and chest radiography in the diagnosis of rib fractures: A systematic review. Emerg Med J 2019; 36: 185-90.
15. Yousefifard M, Baikpour M, Ghelichkhani P, Asady H, Darafarin A, Amini Esfahani MR et al. Comparison of ultrasonography and radiography in detection of thoracic bone fractures; a systematic review and meta-analysis. Emerg (Tehran) 2016; 4: 55-64.
16. Hwang EG, Lee Y. Simple x-ray versus ultrasonography examination in blunt chest trauma: Effective tools of accurate diagnosis and considerations for rib fractures. J Exerc Rehabil 2016; 12: 637-41.

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Original Article

The selective role of radiological findings and PET-CT in solitary pulmonary nodules

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ABSTRACT

Background: The aim of this study is two-fold; first is to investigate the determinants of malignancy from the clinical and radiological results of patients operated on solitary pulmonary nodules (SPN) and second is to determine the SUVmax threshold value for predicting malignancy based on nodule size. While the literature tends to focus on many variables as a group for understanding the SPN-malignancy link, this study asks whether we could weigh size more compared to other factors to decide on malignancy potential. The fact that the incidental finding of SPNs is on rise means timely prediction and cure are within our reach.

Materials and Methods: Patients operated in our clinic due to SPN between January 2018 and December 2022 were categorized into two groups according to their histopathologic diagnoses as malignant and benign. The clinical and radiological characteristics of the two groups were then analysed.

Results: Among the 522 patients included in the study, 385 (74%) were male and the mean age was 61 ± 10.5 years. The high SUVmax value of the nodule and the presence of lobulation and spiculation were found to be determinant factors for malignancy ($p<0.05$, for all). In addition, SUVmax values of 1.75 for nodules <1 cm in diameter, 2.24 for nodules between 1-2 cm, and 2.55 for nodules >2 cm were determined as malignancy predictors.

Conclusions: High SUVmax and the presence of lobulation and spiculation are positive predictive factors for malignancy in SPNs. We believe that the SUVmax value is discretely (by itself) critical in predicting malignancy according to the diameter of the nodule. As size is a relatively straightforward variable to measure and SPN is largely curable with timely intervention, the capacity of size to be a predictor would be highly convenient. In this respect, to better exploit the SUVmax indicator in practice during prognosis, more sensitive cut-off values in an ascending/descending order of the module diameter could be defined.

Keywords: FDG-PET/CT, lung cancer, solitary pulmonary nodule

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Introduction

A solitary pulmonary nodule (SPN) is a radiologic manifestation defined as a round or oval lesion with a diameter of ≤3 cm, unaccompanied by atelectasis, pneumonia, or lymphadenopathy, and fully separated from the surrounding intact lung tissue [1,2]. SPNs are classified as either solid or subsolid nodules while subsolid nodules are further subdivided into part-solid or ground glass nodules (GGN) [2]. With the increased use of high-resolution computed tomography, our capability to observe solitary pulmonary nodules (SPNs) increased along with the frequency of actual findings of SPNs. [3]. According to low-dose computed tomography (CT) screening tests, the incidence of nodular lesions is 19.5%, and most of these nodules are benign. A malignancy rate of 3% is observed in nodules detected during screening, while malignancy is observed at rates ranging up to 60% in nodules detected following clinical symptoms [4].

Functional imaging techniques such as Positron Emission Tomography-Computed Tomography (PET-CT) are essential due to the well-known, widespread complications of radiologic imaging techniques encountered in distinguishing the malignant from the benign [5]. PET-CT containing 18F-fluorodeoxyglucose (FDG) is particularly effective in differentiating between benign and malignant SPNs [6]. Chest radiography, CT, and PET-CT have been proven to complement each other in diagnosing lung cancer [7]. The accurate classification of SPNs can be achieved by considering patient risk factors and radiologic features together in a holistic manner. Identifying SPN enables early diagnosis and treatment in patients with malignant tumors and thus prevents unnecessary, undesirable intervention in benign cases.

In the present study, predictors of malignancy in SPNs were investigated in a large study cohort.

Materials and methods

The present study is a retrospective, single-center, observational study designed in a teaching and research hospital, which is a reference center for chest diseases and thoracic surgery. The patients who were operated on SPNs were reviewed.

Organization of the thoracic surgery clinic and operations

In our clinic, operation decisions and treatment management policies are, in their entirety, under the responsibility of surgery councils. Thoracic surgeons and pulmonologists are the main members of these councils. Other regular participants include specialists from oncology, radiology, radiation oncology, nuclear medicine, and pathology.

Study design

The study included 522 patients who underwent surgery due to SPN between January 2018 and December 2022. Patients with a history of malignancy within the last 5 years, multiple nodules, and histopathologic diagnosis of metastasis were excluded from the study.

Demographic characteristics of patients, size, and location of nodules, PET-CT FDG uptake, type of surgical resection, and final histopathologic diagnosis were recorded. Density was calculated according to the Hounsfield Unit (HU) scale.

Radiological images of all patients were evaluated by an inter-branch joint council of three chest surgeons, one pulmonologist, and one radiologist. Solid component, lobulation, spiculation, air bronchogram, pleural indentation, calcification, and cavitation conditions were recorded.

Patients were categorized into two groups according to their histopathologic diagnoses, namely, malignant and benign. Clinical and radiologic results of all patients were compared between the two groups. This study was approved by the Sureyyapasa Chest Diseases and Thoracic Surgery Training and Research Hospital Ethics Committee. (03.03.2023, No: 116.2017.R-269).

Statistical Analysis

All data are expressed as mean ± standard deviation. A Chi-square and Student's t-test were used to evaluate the data obtained from inter-group comparison. The diagnostic values of the statistically significant parameters were evaluated in accordance with the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV), and from the cut-off values obtained from receiver operating characteristic (ROC) curves. All statistical analysis was carried out using statistical software package system (SPSS for Windows, version 16.0; SPSS Inc., Chicago, IL, USA). A p value of < 0.05 was considered significant.

Results

Among the 522 patients included in the study, 385 (74%) were male and the mean age was 61 ± 10.5 years. The most common location of SPN was the upper lobe of the right lung (34%). The mean nodule size was 1.858 ± 0.6 cm (0.5-3.0), and the mean SUVmax value was 5.4 ± 4.18 (NA-19) (Table 1). Among the patients, 360 (69 %) underwent video-assisted thoracoscopic surgery and 162 (31%) underwent thoracotomy. The pathology result was reported as 326 (62.5%) malignant and 196 (37.5%) benign. The most common malignant histopathological diagnosis was adenocarcinoma (210, 64%) while the most common benign diagnosis was chronic inflammation and fibrosis.

The joint council retrospectively analyzed PET-CT images of the patients, and the mean nodule density was calculated as -14.9 ± 115 (NA-19). The number of solid nodules was 343 (65%). Lobulation was observed in 164 (31%), spiculation in 153 (29%), and pleural indentation in 222 (42%) (Table 1).

According to the comparison between malignant and benign patient groups, the mean age was significantly higher in the malignant patient group (63.8 ± 8.5 p = 0.0001). There were 257 (78%) male patients in the malignant patient group (p = 0.001). While the side location of the nodule was similar between the two groups (p = 0.855), upper lobe location was significantly more prevalent in the malignant group (p = 0.013). The mean nodule size was statistically higher in the malignant group (<0.0001), and the size >2 cm was significant for malignancy (<0.0001). The mean SUVmax was higher in the malignant group with statistical significance (6.81 ± 4.24, 3.18 ± 2.91, p < 0.0001). The density values of the nodule were similar between the two groups (p = 0.514) (Table 1).

The incidence of malignancy was higher in solid lesions compared to subsolid lesions and GGOs (p = 0.023). Lobulation and spiculation were statistically more common in the malignant patient group (p = 0.032, p < 0.001) while air bronchogram, pleural indentation, calcification, and cavitation findings were similar in both groups (p > 0.05) (Table 1).

When the malignancy-wise significant parameters were evaluated by multivariate analysis, the high SUVmax value of solitary pulmonary nodule and the presence of lobulation and spiculation were found to be positive predictive factors for malignancy (p < 0.05) (Table 2). Among these, SUVmax could further be distinguished with more robust predictive prowess for two reasons. First, because it is measurable and hence practical to earmark malignancy. Second, rather than being an either/or (either present or absent) factor such as lobulation, SUVmax is sensitive to the patient's overall conditions, implying that its size along with other factors promises an accurate diagnosis for the individual patient.

In comparing the mean SUVmax values according to nodule size in malignant and benign patients, we observed that the SUVmax value was markedly higher in the malignant group with a statistical significance (p < 0.0001) (Table 3). The SUVmax value of 1.75 (AUC: 0.749 (0.640-0.858) std error: 0.055) was determined as the malignancy marker for nodules smaller than 1 cm with 85% sensitivity and 42% specificity (Figure 1) and the SUVmax value of 2.24 (AUC: 0.706 (0.642-0.771) std error: 0.033) was determined as the malignancy marker for nodules between 1 and 2 cm with 85% sensitivity and 43% specificity (Figure 2). In addition, the SUVmax value of 2.55 (AUC: 0.840 (0.777-0.903) std error: 0.032) was determined as the malignancy marker for nodules >2 cm with 91% sensitivity and 48% specificity (Figure 3).

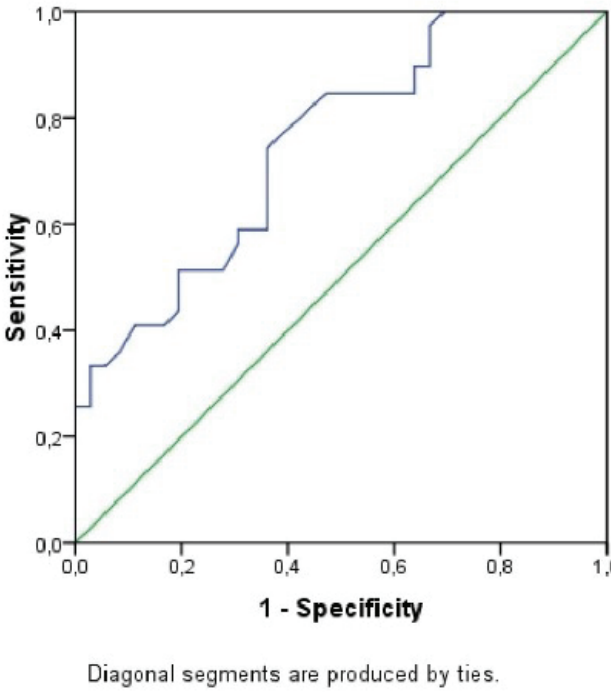

Figure 1. ROC curve for nodules <1 cm. (Area under curve (AUC): 0.749 (0.640-0.858) std error: 0.055).

Table 1. Clinical and radiological features of 522 patients.

	Study population (n=522)	Malignant (n=326, 62.5%)	Benign (n=196, 37.5%)	P value
Age (mean±SD)	61±10.5 (24-88)	63.8±8.5	56.5±12	<0.0001
Gender				
Male	385 (74)	257 (78)	128 (65)	0.001
Female	137 (26)	69 (22)	68 (35)	
Location				
Right lung	302 (58)	187 (58)	115 (59)	0.855
Left lung	220 (42)	139 (42)	81 (41)	
Lobar location				
RUL	177 (34)	124 (38)	53 (27)	<0.0001
RML	34 (6)	10 (3)	24 (12)	
RLL	92 (18)	54 (17)	38 (19)	
LUL	129 (25)	81 (25)	48 (25)	
LLL	90 (17)	57 (17)	33 (17)	
Lobar location				
Upper lobe	306 (59)	205 (63)	101 (51)	0.013
Non-upper lobe	216 (41)	121 (37)	95 (49)	
Size (mm, mean ± SD)	1.858±0.6 (0.5 – 3.0)	1.950±0.6	1.705±0.6	<0.0001
Size (N, %)				
≤1 cm	79 (15)	43 (13)	36 (18)	<0.0001
1-2 cm	254 (49)	144 (44)	110 (56)	
>2 cm	189 (36)	139 (43)	50 (26)	
Size				
≤2 cm	333 (64)	187 (57)	146 (75)	<0.0001
>2 cm	189 (36)	139 (43)	50 (25)	
PET suv (mean ± SD)	5.4±4.18 (NA – 19)	6.81±4.24	3.18±2.91	<0.0001
Density (median ± SD)	-14.9±115 (Min:-869, max: 330)	-17,48±119.6	-10,63±109.6	0.514
Solid component				
Solid	343 (65)	228 (70)	115 (59)	0.023
Subsolid	145 (28)	78 (24)	67 (34)	
GGO	34 (7)	20 (6)	14 (7)	
Solid component				
Solid	343 (65)	228 (70)	115 (59)	0.007
Non-solid	179 (35)	98 (30)	81 (41)	
Lobulation				
Present	164 (31)	114 (35)	50 (25)	0.032
Absent	358 (69)	212 (65)	146 (75)	
Spiculation				
Present	153 (29)	137 (42)	16 (8)	<0.001
Absent	369 (71)	189 (58)	180 (92)	
Air bronchogram				
Present	61 (12)	42 (13)	19 (10)	0.326
Absent	461 (88)	284 (87)	177 (90)	
Pleural indentation				
Present	222 (42)	136 (41)	86 (44)	0.647
Absent	300 (58)	190 (59)	110 (56)	
Calcification				
Present	64 (12)	37 (11)	27 (14)	0.491
Absent	458 (88)	289 (89)	169 (86)	
Cavitation				
Present	30 (6)	21 (6)	9 (5)	0.556
Absent	492 (94)	305 (94)	187 (95)	

Abbrev.: RUL; right upper lobe, RML; right middle lobe, RLL; right lower lobe, LUL; left upper lobe, LLL; left lower lobe, GGO; ground glass opacity.

Table 2. Multivariate analysis of potential factors for predicting malignancy.

	HR	95% confidence interval	P value
SUVmax value	0.865	0.814-0.919	<0.0001
Lesion size	0.689	0.482-0.985	0.041
Age	0.941	0.920-0.962	<0.0001
Gender	0.696	0.426-1.136	0.147
Lobulation	0.408	0.250-0.668	<0.0001
Spiculation	0.113	0.061-0.210	<0.0001
Localization (upper lobe/non-upper lobe)	1.092	0.694-1.716	1.092
Solid component (Solid vs. non-solid)	1.066	0.665-1.707	1.066

Table 3. The average PET-SUVmax values to predict malignancy according to nodule diameter.

	Study population (n=522)	SUVmax (mean±SD)	P value
≤1 cm benign	38	2.133±1.8	
≤1 cm malignant	42	4.537±2.9	
1-2 cm benign	113	3.436±3.2	0.0001
1-2 cm malignant	137	5.986±3.9	
>2 cm benign	53	3.350±2.7	
>2 cm malignant	139	8.206±4.3	

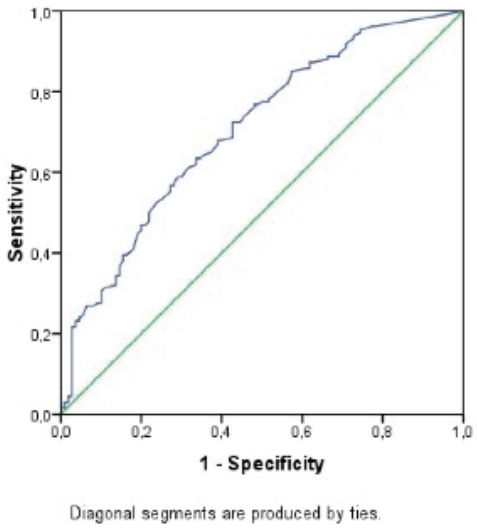

Figure 2. ROC curve for nodules between 1-2 cm. (Area under curve (AUC): 0.706 (0.642-0.771) std error: 0.033).

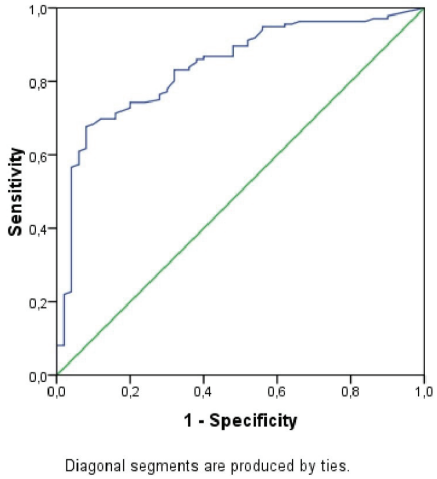

Figure 3. ROC curve for nodules >2 cm. (Area under curve (AUC) 0.840 (0.777-0.903) std error: 0.032).

Discussion

The present study analyzes malignancy predictors of SPNs in depth in a large study group. While the study yielded lobulation and spiculation as independent risk factors, the more remarkable result of the study was establishing the statistical overlaps/similarities among air bronchogram, pleural indentation, calcification, and cavitation rates. These overlaps led us to search for a more accurate determinant for malignancy. It is widely acknowledged that malignancy risk is not easily tested and resolved; nodule-specific as well as patient-specific factors complicate the prognosis process, especially the decision about patient surveillance. In this respect, our finding of PET-BT cut-off based on nodule size could also imply that both patient-specific factors and nodule-related elements are inherent SUVmax. This, in turn, could facilitate decision making.

A comprehensive clinical history is essential in the evaluation of an SPN. A successful classification of the patients presenting with SPN can be achieved by considering patient risk factors together with radiologic features. Such evaluation secures timely diagnosis and thus successful treatment in patients with malignant tumors while minimizing unnecessary intervention in otherwise benign cases [8].

Several clinical studies have reported that age, history of smoking, and cancer background are associated with a high risk of malignancy in patients with SPN [9,10]. Erdogdu et al found that age above 61 was an

independent risk factor for malignancy [8]. In our study, the mean age was significantly higher in malignant patients in one-way analyses; however, it was similar between the two groups in multi-way analyses. It could thus be proposed that the predictive prowess of age may be ambiguous.

On computed tomography (CT) scans, the main features defining the nodule are: size, shape, density, presence of calcification, and growth rate [3,11]. Nodular lesions with pleural recession, lobule contours, and spicular extensions are more likely to be malignant. Several studies have reported spicular extensions as markers of malignancy in nodules [8,12]. While spicular extension was also observed as a marker of malignancy in our study, the presence of lobulation was also determined as a marker. Ambrossini et al. reported that aHU index of ≥15 was a predictive factor for malignancy [13]. In our study, density values were found to be similar between the two groups. Calcified nodules are generally benign [14]. Yet, up to 6-10% of primary lung cancers exhibit calcification on CT [15]. Benign nodules, especially hamartomas, exhibit diffuse calcification patterns in addition to popcorn-like pathognomonic calcification. Punctate and eccentric calcification patterns are also screened in malignant nodules [15]. Cavitation occurs in both benign and malignant conditions [16]. While air bronchograms are frequently encountered in infectious conditions, they are especially present/common in malignant nodules in SPN [17]. Similar rates of calcification, cavitation, and air bronchograms were observed in both groups in our results. Again, the similarity in both groups alarmed us that we needed a safer predictive factor, delving deeper into the different values for the two groups to distinguish a factor that could have a causal relationship to malignancy.

The location of SPNs may also help determine the risk of malignancy. Some studies have reported that the upper lobe is associated with an increased risk of malignancy and that particularly right upper lobe commands the highest malignancy rate with 45% of all malignant nodules [18]. On the other hand, another group of studies have concluded that location may not constitute a significant malignancy marker [8,12]. In our study, in line with the latter group of studies, although upper lobe location was significantly more prevalent in the malignant group, it was not considered a malignancy marker in multidimensional analyses.

While some studies have reported a positive correlation between the diameter of the nodule and malignancy, others have not observed such a phenomenon [19,20]. According to the studies of the Fleischner Society, approximately 80% of lesions larger than 20 mm were identified as malignant, while 1% of lesions 2-5 mm in size were identified so [21]. A further research demonstrated that the probability of malignancy ranged from 6% in nodules with a size of 5-10 mm to 64% in nodules larger than 20 mm [2]. The volume doubling time (VDT), the time it takes for the nodule to double in volume or increase in diameter by 26%, can also serve as a measure for assessing the growth of the SPN and predicting benignity/malignancy [22]. In this sense, numerous studies have reported a mean duration of VDT of 139 days for lung malignancy [23]. In our study, the mean nodule size was statistically greater in the malignant group, and a size of >2 cm was significant for malignancy.

With the popularity and prevalence of screening examinations in recent years, several models have been developed to help determine the risk of malignancy. In this sense, the Mayo model reported six independent risk factors: age, smoking history, history of extrapulmonary tumor, maximum diameter, nodule location, and spiculation [13]. The Veterans Affairs (VA) model, on the other side, reported age, smoking history, smoking cessation time, and nodule diameter as independent risk factors for malignancy [14]. According to the Peking University People's Hospital (PKUPH) model, the independent risk factors constituted age, nodule diameter, family history of cancer, and spiculation [12]. These models are effective for decision-making in the case of suspected malignancy, yet their results may produce rather approximate and vague pictures. As more clarity is a must for individual evaluations and decisions on the mode of patient surveillance, we asked whether a concrete factor could be separated.

Functional imaging capabilities such as PET-CT are necessary due to the complications of radiological imaging techniques in differentiating between malignant and benign cases [5]. The FDG PET-CT method provides morphological and metabolic information about

the lesions, enabling semi-quantitative evaluation by calculating the maximum standardized uptake value (maxSTD) besides visual evaluation [24]. Considering the threshold value for maxSTD as 2.5, the sensitivity and specificity of FDG PET-CT examination in detecting malignant lesions were determined as 95.1% and 50.0%, respectively [25]. The FDG PET-CT has a high level of accuracy for diagnosing malignancy in nodules, and a recent meta-analysis reported a sensitivity and specificity of 89% and 70%, respectively [26]. In parallel, in our case, the mean SUVmax was found higher in the malignant group with a statistical significance.

PET-CT plays an essential role in characterizing the nature of pulmonary nodules, yet its predictive power is reduced in nodules smaller than 1 cm [27]. The sensitivity of PET-CT was reported as 69% for nodules with a diameter of 5-10 mm and 95% for nodules larger than 10 mm [28]. In active granulomatous infections, most commonly tuberculosis, high FDG values are known to produce false positive results in the differential diagnosis of malignancy [29]. In addition, it may produce false negative results for carcinoid tumors, adenocarcinoma subtypes, and lung tumors smaller than 1 cm [6]. Amidst these errors, some modifications have been made to increase the sensitivity and specificity of FDG PET-CT in evaluating SPNs. Matthies et al reported a 20% increase in sensitivity in detecting malignant lesions using the dual-phase method [30]. On the other hand, Fletcher et al concluded in a meta-analysis that the dual-phase method had zero contribution to the differential diagnosis of malignant lesions [31]. Another type of modification was performed in clinical trials using a ranking scale comparing the SUVmax cut-off value to the mediastinal blood pool. It was reported that normalization of SUVmax to blood pool or liver uptake had high diagnostic accuracy for detecting malignancy in SPNs, with AUCs of 0.90 for both liver and blood uptake rates [32].

Several clinical trials have identified malignancy markers of SPNs by evaluating CT features, patient risk factors, and F-18 FDG PET-CT results. In a study including 223 patients with a radiologic diagnosis of the solitary pulmonary nodule, Erdogdu et al demonstrated that an SUVmax value greater than 2.5, spicular extension, and age above 61 years were independent markers of malignancy [8]. Lopez et al. also revealed that SUVmax value and age were independent variables in predicting malignancy [33]. In a recent multi-center study on 355 patients, Weir-McCall et al reported that SUVmax was the most accurate technique in diagnosing solitary lung nodules; however, they also showed that the diagnostic thresholds should be modified according to nodule size. They determined the optimal thresholds for SUVmax according to lesion size and set them as 1.75 for lesions <12 mm, 2.55 for lesions ranging between 12 and 16 mm, and 3.6 for lesions >16 mm [34]. In our study, we propose the following nodule size-SUVmax pairs: the SUVmax value of 1.75 in nodules smaller than 1 cm; 2.24 in nodules between 1 and 2 cm; 2.55 in nodules greater than 2 cm. These proposed thresholds, rather easy to assess, would provide a timely evaluation and save various treatment costs by excluding benign cases. Avoiding the needless intervention in the patients' daily lives would also be a plus.

Our study reports the following important limitations: being retrospective and being single-centered. On the other hand, our study has been conducted on a large group in a specialist pulmonary diseases center where our patients are fully examined and where all procedures are followed in detail, from detection to the probable operation. Therefore, the patient population here is a special focus group. Another strength is the rich size of the population along with the range of patient profiles, rendering our findings robust.

In conclusion, the presence of radiological spiculation and lobulation along with high PET-CT SUVmax values strongly signal malignancy, making these variables critical factors for deciding on the follow-up or treatment of SPNs. The increased technological capacity of successful detection of millimetric lesions with the growing use of high-resolution computed tomography could be harnessed for better test/decision criteria. In this respect, the standard SUVmax threshold value, in its extant form, may be insufficient for diagnostic prediction in these lesions and prone to spurious results. The SUVmax diagnostic threshold value should be updated to be set in a step-wise manner according to nodule sizes. The inclusion of such a sensitive predictive element in evaluations may lead to better decisions early on.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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Ethics approval

This study was approved by the Sureyyapasa Chest Diseases and Thoracic Surgery Training and Research Hospital Ethics Committee. (03.03.2023, No: 116.2017.R-269).

Authors' contributions

MA,AU,FTA; conception and design, VB,EEK,SB; administrative support, AU,EY,MA; provision of study materials or patients, MA,AU,ŞB,SB; collection and assembly of data, FTA,MA,ŞB,SE; data analysis and interpretation, MA,AU; manuscript writing. All authors have read and approved the final manuscript.

References

1. Tan BB, Flaherty KR, Kazerooni EA, Iannettoni MD. American College of Chest Physicians. The solitary pulmonary nodule. Chest 2003; 123: 89-96.
2. Larici AR, Farchione A, Franchi P, Ciliberto M, Cicchetti G, Calandriello L et al. Lung nodules: size still matters. Eur Respir Rev 2017; 26: 1-16.
3. Brandman S, Ko JP. Pulmonary nodule detection, characterization, and management with multidetector computed tomography. J Thorac Imaging 2011; 26: 90-105.
4. Silva M, Pastorino U, Sverzellati N. Lung cancer screening with low-dose CT in Europe: strength and weakness of diverse independent screening trials. Clin Radiol 2017; 72: 389-400.
5. Yilmaz F, Tastekin G. Sensitivity of 18F-FDG PET in evaluation of solitary pulmonary nodules. Int J Clin Exp Med 2015; 8: 45–51.
6. Nomori H, Watanabe K, Ohtsuka T, Naruke T, Suemasu K, Uno K. Visual and semiquantitative analyses for F-18 fluorodeoxyglucose PET scanning in pulmonary nodules 1 cm to 3 cm in size. Ann Thorac Surg 2005; 79: 984-8.
7. Bombardieri E, Buscombe J, Lucignani G, Schober O. Advances in Nuclear Oncology Diagnosis and Therapy. Lung Cancers 2007; 5: 62-80.
8. Erdogdu E, Ozkan B, Duman S, Agkoc M, Erturk S.M, Kara M et al. Predictors of Malignancy in Patients with Solitary Pulmonary Nodules Undergoing Pulmonary Resection. Clin. Respir J 2022; 16: 361-8.
9. Schultz EM, Sanders GD, Trotter PR, Patz Jr EF, Silvestri GA, Owens DK et al. Validation of two models to estimate the probability of malignancy in patients with solitary pulmonary nodules. Thorax 2008; 63: 335-41.
10. Mery CM, Pappas AN, Bueno R, Mentzer SJ, Lukanich JM, Sugerbaker DJ et al. Relationship between a history of antecedent cancer and the probability of malignancy for a solitary pulmonary nodule. Chest 2004; 125: 2175-81.
11. Mikita K, Saito H, Sakuma Y, Kondo T, Honda T, Murakami S et al. Growth rate of lung cancer recognized as small solid nodule on initial CT findings. Eur J Radiol 2012; 81: 548-53.
12. Xiao F, Liu D, Guo Y, Shi B, Song Z, Tian Y et al. Novel and convenient method to evaluate the character of solitary pulmonary nodule-comparison of three mathematical prediction models and further stratification of risk factors. PLoS ONE 2013; 8: e78271.
13. Swensen SJ, Viggiano RW, Midthun DE, Müller NL, Sherrick A,Yamashita K et al. Lung nodule enhancement at CT: multicenter study. Radiology 2000; 214: 73-80.
14. Li Y, Wang J. A mathematical model for predicting malignancy of solitary pulmonary nodules. World J Surg 2012; 36: 830-5.
15. Khan AN, Al-Jahdali HH, Allen CM, Irion KL, Al Ghanem S, Koteyar SS. The calcified lung nodule: what does it mean? Ann Thorac Med 2010; 5: 67-79.
16. Truong MT, Ko JP, Rossi SE, Rossi I, Viswanathan C, Bruzzi JF et al. Update in the evaluation of the solitary pulmonary nodule. Radiographics 2014; 34: 1658-79.
17. Algin O, Gokalp G, Topal U. Signs in chest imaging. Diagn Interv Radiol 2011; 17: 18-29.
18. Horeweg N, van Rosmalen J, Heuvelmans MA, van der Aalst CM, Vliegenthart R, Scholten ET et al. Lung cancer probability in patients with CT-detected pulmonary nodules: a prespecified analysis of data from the NELSON trial of low-dose CT screening. Lancet Oncol 2014; 15: 1332-41.
19. Yang D, Li Y, Liu J, Jiang G, Li J, Zhao H et al. Study on solitary pulmonary nodules: correlation between diameter and clinical manifestation and pathological features. Zhongguo Fei Ai Za Zhi 2010; 13: 607-11.

20. Nguyen NC, Kaushik A, Wolverson MK, Osman MM. Is there a common SUV threshold in oncological FDG PET/CT, at least for some common indications? A retrospective study. Acta Oncologica 2011; 50: 670-77.

21. Hansell DM, Bankier AA, MacMahon H, McLoud TC, Müller NL, Remy J et al. Fleischner Society: glossary of terms for thoracic imaging. Radiology 2008; 246: 697-722.

22. Bailly P, Bouzerar R, Shields T, Meyer ME, Daouk J. Benefits of respiratory-gated 18 F-FDG PET acquisition in lung disease. Nucl Med Commun 2018; 39: 44-50.

23. Walter JE, Heuvelmans MA, de Jong PA, Vliegenthart R, van Ooijen PMA, Peters RB et al. Occurrence and lung cancer probability of new solid nodules at incidence screening with low-dose CT: analysis of data from the randomised, controlled NELSON trial. Lancet Oncol 2016; 17: 907-16.

24. Czernin J, Allen-Auerbach M, Nathanson D, Herrmann K. PET/CT in Oncology: Current Status and Perspectives. Curr Radiol Rep 2013; 1: 177-90.

25. Hou S, Lin X, Wang S, Shen Y, Meng Z, Jia Q et al. Combination of positron emission tomography/computed tomography and chest thin-layer high resolution computed tomography for evaluation of pulmonary nodules: Correlation with imaging features, maximum standardized uptake value, and pathology. Medicine (Baltimore) 2018; 97: e11640.

26. Li Z-Z, Huang Y-L, Song H-J, Wang Y-J, Huang Y. The value of 18 F-FDG-PET/CT in the diagnosis of solitary pulmonary nodules: a meta-analysis. Med (Baltimore) 2018; 97: e0130.

27. Ambrosini V, Nicolini S, Caroli P, Nanni C, Massaro A, Marzola MC et al. PET/CT imaging in different types of lung cancer: an overview. Eur J Radiol 2012; 81: 988-1001.

28. Bakheet SM, Saleem M, Powe J. F-18 FDG chest uptake in lung inflammation and infection. Clin Nucl Med 2000; 25: 273-8.

29. Li Y, Su M, Li F, Kuang A, Tian R. The value of ^{18}F-FDG-PET/CT in the differential diagnosis of solitary pulmonary nodules in areas with a high incidence of tuberculosis. Ann Nucl Med 2011; 25: 804-11.

30. Matthies A, Hickeson M, Cuchiara A, Alavi A. Dual time point 18F FDG PET for the evaluation of pulmonary nodules. J Nucl Med 2002; 43: 871 5.

31. Fletcher JW, Kymes SM, Gould M, Alazraki N, Coleman RE, Lowe VJ et al. A comparison of the diagnostic accuracy of 18FFDG PET and CT in the characterization of solitary pulmonary nodules. J Nucl Med. 2008; 49: 179-85.

32. Evangelista L, Cuocolo A, Pace L, Mansi L, Del Vecchio S, Miletto P et al. Performance of FDG-PET/CT in solitary pulmonary nodule based on pre-test likelihood of malignancy: results from the ITALIAN retrospective multicenter trial. Eur J Nucl Med Mol Imaging 2018; 45: 1898-907.

33. Lopez OVG, Vicente AMG, Martínez AFH, Londono GAJ, Caicedo CHV, Atance PL et al. 18F-FDG-PET/CT in the assessment of pulmonary solitary nodules: comparison of different analysis methods and risk variables in the prediction of malignancy. Transl Lung Cancer Res 2015; 4: 228-35.

34. Weir-McCall JR, Harris S, Miles KA, Qureshi NR, Rintoul RC, Dizdarevic S et al. Impact of solitary pulmonary nodule size on qualitative and quantitative assessment using 18F-fluorodeoxyglucose PET/CT: The SPUTNIK trial. Eur J Nucl Med Mol Imaging 2021; 48: 1560-9.

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Original Article

Knowledge, attitudes and beliefs of thoracic surgery residents towards theoretical and practical medical life in Turkey

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ABSTRACT

Background: This study aimed to evaluate the perspectives of residents working in thoracic surgery clinics at university, training, and research hospitals in Turkey, regarding their educational experiences, as well as their knowledge, attitudes, and expectations about the theoretical and practical aspects of practice.

Materials and Methods: A total of 180 residents from thoracic surgery clinics in randomly selected university, training, and research hospitals in Turkey were contacted. A 37- question survey was designed using tr.surveymonkey.com and distributed via social media (WhatsApp). Of these, 160 residents participated, and the results were analyzed.

Results: Among the 160 respondents, 94 (58.8%) were male and 66 (41.2%) were female, with a mean age of 29.4 ± 2.9 years (range 25-39). In the medical specialty examination, 137 (85.63%) of the participants ranked thoracic surgery in the 1st to 5th positions. Clinics had a mean of 9 ± 5 residents (range 1-22). 37 (23.1%) reported 8 or more shifts per month, and 31 (19.4%) had no time off after shifts. Approximately 52% of clinics offered an average of 5 ± 2.5 hours of training per month. A total of 109 (68.1%) residents were able to perform cases as the primary surgeon. The main learning sources were mainly senior assistants (41.9%) and faculty members (31.2%). 'Mobbing' was reported by 26 (16.2%), and 88 (55%) expressed future career uncertainty. After training, 43.1% planned to work as specialists, and 32.5% aimed for academic careers.

Conclusion: The study offers insights to enhance thoracic surgery training programs, support residents, and improve professional satisfaction. These findings may guide future strategies and policies to foster a better educational environment in thoracic surgery.

Keywords: survey, residents, education, thoracic surgery, profession

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Introduction

In our country, medical specialty education and its challenges are frequently discussed due to the unfortunate events that have occurred and require legal reforms. In recent years, the increase in the number and diversity of patients, particularly in tertiary healthcare institutions where education is provided, along with advancements in medicine, has led to a rise in the number and complexity of interventions. The combination of specialized education, healthcare delivery, working hours, shift frequency, job security, and working conditions adds to the difficulties faced by residents during their training period. Although these issues are common across all specialties, the long training periods make them more severe and challenging, especially for residents in surgical fields where they encounter more complex and difficult cases and diseases [1].

Medical Specialization Board Curriculum Formation and Standard Setting System (TUKMOS) in Turkey is responsible for reviewing, developing, and formalizing previously established core curricula across all major and subspecialty fields. In this context, the core curriculum for thoracic surgery was finalized on 05.05.2016. In this program, thoracic surgery is defined as a surgical field that deals with lung, mediastinum, diaphragm, esophagus, trachea, pleura, chest wall, and trauma in both adult and pediatric populations [2].

According to TUKMOS, the goal is for a specialist who has completed their education to be capable of independently diagnose diseases related to thoracic surgery, performing medical and surgical treatments, providing postoperative care, and managing potential complications. As per this program, the total training duration for thoracic surgery specialization is 5 years, including 1 year dedicated to rotations. The rotations consist of 6 months in general surgery, 3 months in cardiovascular surgery, 2 months in thoracic diseases, and 1 month in anesthesiology and reanimation clinics [2].

The problems frequently encountered in thoracic surgery education include a lack or insufficiency of theoretical and/or practical education, differences in patient diversity across clinics, mobbing, the inability to take leave after shifts, and the inability to actively participate in rotations. This study was designed to substantiate these and similar issues, highlight challenges faced by residents in other clinical disciplines, and propose solutions.

In this survey, the issues faced by thoracic surgery residents during their training will be explored, and concerns related to their profession will be identified. Based on the results of this survey, solutions will be developed for the identified problems, and the findings will be communicated to relevant authorities through the Thoracic Surgery Association to guide legal reforms.

Materials and methods

Approval for this cross-sectional study was obtained from the University Clinical Research Ethics Committee, with the reference number B.30.2.ODM.0.20.08/629-92. The study population consisted of thoracic surgery residents at the time of the study. No sample was selected; instead, an attempt was made to reach the entire population. As of November 20, 2023, the Republic of Turkey Ministry of Health reported that there were 322 thoracic surgery residents in Turkey. In the study, 180 thoracic surgery residents working in randomly selected university, training, and research hospitals were contacted. A total of 160 thoracic surgery residents completed the questionnaire.

The data collection process was carried out using a questionnaire form, which was created by the researchers after a comprehensive review of the literature. It was made available online via the 'en.surveymonkey.com' website. To ensure the questionnaire was answered objectively, sincerely, realistically in line with its purpose, respondents were informed about the nature, aims, and reasons of the research in the introduction section of the questionnaire and their consent was obtained.

The questionnaire, consisting of a total of 37 multiple-choice questions, included 8 questions on sociodemographic data, 4 questions about the medical specialty examination and the thoracic surgery specialty, and 25 questions addressing participants' working conditions, the facilities and status of their training clinics, theoretical and practical training, rotations, and their thoughts on thoracic surgery specialization.

Inclusion criteria is; being a resident in thoracic surgery clinics, working in a university, training and research hospital, agreeing to participate in the survey. The exclusion criteria is; being a resident in a clinic other than thoracic surgery, having completed thoracic surgery specialty training and refusal to participate in the survey.

Statistical Analysis

The survey results were evaluated using the data obtained from en.surveymonkey.com. Descriptive statistics were presented as numbers, percentages, means ± standard deviations.

Results

Of the 160 thoracic surgery residents who participated in the survey, 94 (58.8%) were male, 66 (41.2%) were female, and the mean age was 29.4 ± 2.9 (range: 25-39) years. The demographic data of the participants are summarized in Table 1.

The mean TUS score of the participants was 51.5 ± 4.7 (range: 45-68). When asked why they preferred the thoracic surgery specialty, the responses were as follows: 53% (n = 80) chose it because they wanted to pursue a surgical specialty, 45% (n = 72) were specifically interested in thoracic surgery, and 2% (n = 3) chose it because it was a specialty accessible with a lower TUS score. The answers given to the questions about the TUS process are presented in Table 2.

Table 1. The social demographic features of participants.

Variable	n	%
Sex		
Female	66	41.2
Male	94	58.8
Marital status		
Single	73	45.6
Married	85	53.1
Divorced	2	1.3
Having children		
No children	123	76.9
1 child	28	17.5
2 children	7	4.3
3 children	2	1.3
Smoking status		
Smoking	50	31.2
Non-smoker	110	68.8
Region		
Marmara	47	29
Central Anatolia	44	28
Aegean	25	16
Black Sea	15	9
Mediterranean	13	8
South-eastern Anatolia	11	7
Eastern Anatolia	5	3

While 60% (n = 96) of the participants were working in a university hospital, 40% (n = 64) were working in a training and research hospital. The average number of patient beds in their clinics was 21 ± 11 beds, with the smallest ward having 5 beds and the largest ward having 60 beds. Additionally, 54% (n = 86) of the clinics had their own intensive care unit.

The distribution of the number of years completed by thoracic surgery residents who participated in the survey is shown in Figure 1.

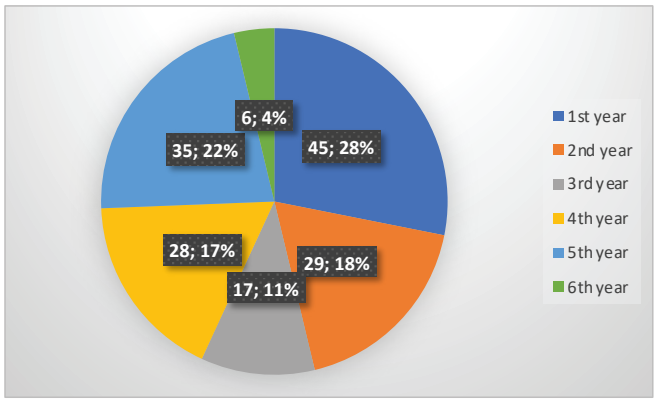

Figure 1. Year of education of the participants in the survey.

On average, thoracic surgery clinics had 9 ± 5 (range: 1-22) residents. The number of residents working shifts varied: 1-3 shifts per month was 30 (18.8%), 4-7 shifts per month was 93 (58.1%), 8-11 shifts per month was 33 (20.6%), and more than 11 shifts per month was 4 (2.5%).

Additionally, 108 (67.5%) of the residents worked shifts alone, while 52 (32.5%) residents worked shifts in pairs. About 80.6% (n = 129) of the participants stated they could take leave after shifts, whereas 19.4% (n = 31) could not.

Approximately 52% of thoracic surgery clinics had an average training program of 5 ± 2.5 (range:1-12) hours per month. Regarding theoretical education, 44% of clinics provided 4.6 ± 2.2 (range:1-10) hours per month. Additionally, weekly scientific and/or case discussion meetings (average 4.2 ± 1.9 hours per month) were held in approximately 70% of the clinics.

When the participants were asked, "Are residents allowed to perform cases as the primary surgeon in your clinic?", 109 (68.1%) responded that they could perform cases independently under the supervision of medical staff. The average time required to perform a case as the primary surgeon under the supervision of a faculty member was 2.7 ± 1.3 years of specialty training.

The response to the question, "From whom or where do you acquire the most theoretical and/or practical knowledge?", is presented in Figure 2.

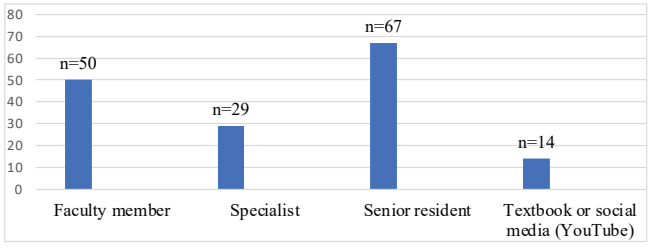

Figure 2. From whom/where thoracic surgery research assistants learn the most theoretical and/or practical knowledge.

Table 2. Questions and answers provided by the participants about the thoracic surgery specialty and TUS process.					
	1-5 (rank)	6-10 (rank)	11+ (rank)	Yes	No
Preference ranking	137 (85.62%)	11 (6.88%)	12 (7.5%)		
"Would you choose again?"				117 (73.1%)	43 (26.9%)

Table 3. Experiences of mobbing among thoracic surgery residents.			
Do you believe that 'mobbing' occurs in your clinic?	Yes	No	I think partly (It occurs to some extent)
	26 (16.2%)	103 (64. %4)	31 (19.4%)
Who do you think is subjected to 'mobbing' in your clinic?	To myself	To another person	
	38 (71.70%)	15 (28.3%)	

When asked, "Which method is primarily used for surgical approaches in your clinic?", the responses were as follows: 94.4% (n = 151) for video-assisted thoracic surgery (VATS), 78.8% (n = 126) for thoracotomy, and 6.9% (n = 11) for robotic-assisted thoracic surgery (RATS).

Eighty-five percent (n = 136) of the participants expressed a preference for rotations between clinics that perform specialized procedures, such as esophageal surgery and endobronchial ultrasonography (EBUS).

When asked about the impact of the COVID-19 pandemic on specialty education, 45% (n = 72) stated that it had a negative impact, 22.5% (n = 36) reported a partially negative impact, and 32.5% (n = 52) indicated that it did not affect their specialty education. Approximately 54% (n = 86) of the participants worked as residents during the COVID-19 pandemic period.

Regarding the adequacy of the 5-year training period in thoracic surgery, 88.7% (n = 142) considered it adequate, 8.8% (n = 14) found it partially adequate, and 2.5% (n = 4) deemed it insufficient.

One of the questions in the questionnaire asked, "Do you have any concerns about your future in the profession?" While 55% (n = 88) of the participants expressed significant concerns, 22.5% (n = 36) reported partial concerns, and 22.5% (n = 36) stated that they had no concerns regarding their professional future.

When the diversity of post-specialty plans was assessed, 43.1% (n = 69) of the participants planned to continue as specialists after completing their specialty training, while 32.5% (n = 52) intended to pursue an academic career. Additionally, 18.1% (n = 29) planned to practice abroad, and 6.3% (n = 10) indicated that they did not intend to specialize further in thoracic surgery after completing their training.

Among the participants, 49% (n = 79) stated that they had attended a scientific congress, and 71% of whom did so with scholarships provided by the association, 19% with support from a corporate sponsor, and 10% through their own financial means.

While 23.7% (n = 38) of the participants reported being informed about the rotation learning objectives set by the medical specialty board, 21.9% (n = 35 indicated being partially informed, and 54.4% (n = 87) stated that they had no knowledge of these learning objectives.

When the effectiveness of the mandatory rotations during the training period was evaluated, 67% (n = 107) of the participants stated that the rotations were inefficient and ineffective. Among the participants who rotated in other clinics during the training period, 13.1% reported being actively involved in the clinics they attended, 33.8% reported being partially active, and 53.1% stated that they did not take an active role in the clinics during their rotations.

Furthermore, 66.9% of the participants expressed that the education they received in the departments they rotated through did not meet their expectations. The responses provided regarding experiences of ‘mobbing’ are presented in Table 3.

Discussion

Thoracic surgery education began with the establishment of the first thoracic residency program at the University of Michigan in 1928 [3]. In Turkey, TUKMOS plays an active role in reviewing, developing and formalizing the previously prepared core curricula in all major and subspecialty areas. Within this framework, thoracic surgery is defined as a surgical branch that encompasses the lung, mediastinum, diaphragm, esophagus, trachea, pleura, chest wall and traumas affecting both the adult and pediatric populations [2].

In Turkey, physicians who earn the title of medical doctor after six years of medical education must take the TUS exam and pass it to specialize. In a study conducted by Akçam et al, thoracic surgery was ranked as the 4th and 1st choice in the TUS preferences, respectively. Furthermore, the reasons for choosing thoracic surgery were reported as interest in the specialty, a desire to perform surgery, and a pursuit of an academic career, respectively [4]. In our study, residents who ranked thoracic surgery between 1st and 5th in their preferences constituted 85.63% of the participants, and 73% indicated that they would choose thoracic surgery again if they had to take the TUS exam again. Regarding the reasons for their preference, half of the participants stated that they chose it because they wanted a surgical specialty, and 45% indicated that they chose it due to their interest in thoracic surgery.

In recent years, there has been a steady increase in the number of women in the medical profession. According to the Association of American Medical Colleges, 49.8% of medical school graduates in 2016 were women [5]. In a study of 23423 physicians conducted by Yılmaz et al in 2021, 41.5% of physicians were female, and 27% of those working in surgical medicine were reported to be female. Notably, 33% of those working in thoracic surgery were female [6]. In our study, 41% of the participants were female, which contrasts with the literature, despite thoracic surgery being a surgical discipline. This finding suggests that the interest of the female gender in surgical specialties has increased over the years.

It has been reported in many studies that excessive working hours and high number of shifts in the medical field are significant risk factors for burnout [7,8]. Residents also reported long working hours and heavy workloads as unfavorable working conditions [9,10]. In a study by Çelik et al, the prevalence of burnout syndrome among thoracic surgeons was found to be 40-50%, a rate similar to that observed across all surgical branches [11]. In our study, 23.1% of the participants reported having eight or more shifts per month, and 67.5% of them were on duty alone during these shifts.

Although it is a legal obligation to take leave after a shift, 19.4% of the participants stated that they were unable to take this leave. We believe that this issue stems from the insufficient number of residents in the clinics and/or an excessive workload.

In a report by the International Labor Organization, it is highlighted that workplace violence, intimidation (mobbing) and burnout have become increasingly prevalent issues on a global scale [12]. Similarly, Xaplanteri et al found that mobbing levels significantly varied significantly across sectors, with the highest scores recorded in the surgical sector and the lowest in the laboratory sector. They attributed this disparity to the intense workload, high-stress environment, and strict hierarchical culture of surgical departments, which were observed to increase interpersonal conflicts and create a conducive environment for mobbing behaviors [13]. Consistent with these findings, our study revealed that 35.6% of participants experienced mobbing in their workplace, with 71.7% of them perceiving the mobbing as being directed specifically at them.

For effective residency training, at least 20 hours per week should be dedicated to education [14]. However, studies conducted throughout Turkey reported that only 2.5% of residents prioritized education, theoretical education was considered non-essential in one out of three specialty training institutions and mortality/morbidity meetings were held in only one out of four institutions [15,16]. In our study, 52% of the clinics had an educational program comprising an average of 5 ± 2.5 hours per month, theoretical education was provided in 42% of the clinics, and scientific meetings were organized in 70% of the clinics. Regarding practical training, 68.1% of the residents were allowed to perform cases as the primary surgeon.

Education in medicine is directly related to seniority and the experiences gained through seniority at every stage. Most theoretical and practical training is received from senior physicians. In the study by Akçam et al, 55.7% of the participants stated that their primary source of information was senior residents, while 32.6% reported classical books as their main source of information [4]. Similarly, in our study, 41.8% of the participants stated that their primary source of information was the senior resident, while 31.25% identified faculty members. Approximately 9% of the participants reported using textbooks or social media as their usual source of information.

In recent years, with the development of VATS and RATS in our country, the decline in thoracotomy approaches is thought to negatively impact resident training in open surgery [17,18]. However, when the preferred clinical surgical approach was examined in our study, 151 residents reported using VATS, while 126 residents reported using thoracotomy. We believe this reflects the diversity of cases encountered in our country, where, unfortunately, a significant proportion of patients present at locally advanced stages. Additionally, the high incidence of tuberculosis in our country leads to the presence of advanced intrathoracic adhesions, which is one of the most important factors limiting the use of VATS. However, despite its challenges, this situation increases the number and variety of cases observed and/or performed by thoracic surgery residents during specialty training. Moreover, the experience gained from open and complex operations provides a strong foundation for VATS and RATS training, thereby potentially shortening the training period and improving proficiency in minimally invasive techniques.

Another problem is that some clinics perform specialized surgical interventions (EBUS, esophageal surgery), which creates a significant disparity in training opportunities among clinics. In our study, 85% of the participating residents expressed a desire to address this disparity through rotations among clinics. To achieve this, residents and lecturers in our clinic frequently participate in national and international rotations and training programs.

The COVID-19 pandemic has negatively impacted medical education at all levels in our country as well as globally. These disruptions have particularly affected the education of residents in surgical specialties, including thoracic surgery [19]. In our study, 45% of the participants reported that their specialty education was severely affected by the pandemic, while 22.5% indicated that it was partially affected. Considering that 36% of the participants were 1st and 2nd-year residents, it can be inferred that nearly all residents whose training overlapped with the pandemic were significantly impacted. Similarly, Daniel et al emphasized that the pandemic posed unprecedented challenges to education systems worldwide, compelling institutions to rapidly transition from face-to-face education to remote learning with limited preparation time. This abrupt shift disrupted traditional teaching methods and exacerbated existing inequalities in access to educational resources, especially in technologically underprivileged settings [20]. The findings of our study align with these observations, underscoring the profound impact of the pandemic on surgical education, which heavily depends on hands-on training and face-to-face mentorship.

Akçam et al reported that 67.3% of thoracic surgery residents found the five-year training period sufficient [4]. In our study, 97.5% of thoracic surgery residents found the five-year training period sufficient. However, only 23.7% of the participants in our survey stated that they were fully informed about the rotation learning objectives set by the medical specialty board. In the study conducted by Çıtak et al in 2012, participants were asked which rotations they had actively performed or planned to perform. 44.8% of the participants answered general surgery, 26.9% cardiovascular surgery, 22.4% chest diseases, 13.4% anesthesiology and reanimation, 16.4% selected all of them, and 37.3% indicated none of them. In contrast, only 33% of the participants in our study stated that they had completed the required clinical rotations. Despite the passage of time, no significant improvement has been achieved in fulfilling the rotation learning objectives, and the rotations that did take place were not aligned with these objectives.

According to the Turkish Medical Association, more than 1400 physicians migrated abroad in 2021, and the total number of physicians migrating abroad in the past decade has reached 4000 [21]. Furthermore, a study on medical students in Turkey, 94% of the students were considering practicing medicine abroad [22]. In our study, 55% of thoracic surgery residents expressed concerns about their future profession, and we found that 43.1% of the participants planned to work as thoracic surgery specialist, 32.5% aimed to pursue an academic career, and 18.1% intended to practice abroad once their specialty training was completed.

In our study, significant findings were obtained by comprehensively examining the training processes, professional satisfaction, and challenges faced by thoracic surgery residents. The increase in the number of female surgeons' highlights progress in gender diversity within the surgical, indicating that interest in thoracic surgery is growing, which suggests that this trend will likely continue in the future. Issues such as burnout, mobbing, and disruptions in education caused by long working

hours and high workload have a negative impact on professional development and satisfaction. Considering the adverse effects of the COVID-19 pandemic on education, it is crucial to focus on how training processes can be improved during such crises.

The importance of interactions with senior residents and instructors as a significant source of knowledge underscores the need to enhance their roles and effectiveness in education. Additionally, the fact that the majority of residents are satisfied with their choice of the thoracic surgery specialty and would choose the same specialty again if they retook the TUS highlights the specialty's appeal and the effectiveness of the training. However, professional concerns and plans to work abroad provide important feedback on medical education and the healthcare system in Turkey.

One of the limitations of our study is the difficulty in reaching thoracic surgery residents, which may have affected the representativeness of our sample. Additionally, the lack of a dedicated communication network for thoracic surgery residents further contributed to the challenges in data collection. These, which we were able to address, might have influenced the scope and depth of the insights we gathered regarding the residency program and its associated issues.

In conclusion, our study offers valuable insights for improving thoracic surgery training programs, supporting residents in all aspects, and increasing their professional satisfaction. These findings can contribute to the development of future educational strategies and policies, helping to create a more effective and sustainable educational environment in the field of thoracic surgery.

Declaration of conflicting interests

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Ethics approval

This cross-sectional study was approved by the Ondokuz Mayıs University Clinical Research Ethics Committee, with the reference number B.30.2.ODM.0.20.08/629-92.

Authors' contributions

Cİ: Conceptualization of the research idea, study design, data collection, analysis, and manuscript preparation, MGP: study design, survey preparation, statistical analyses, and manuscript review, BÇ: literature review, data collection, survey preparation, and evaluation of study findings, YBB: evaluation of study data, language and content editing, and final proofreading of the manuscript.

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References

1. Guo C, Liu L, Zhang J, Zhao K, Li S. Revolutionizing thoracic surgery education: a bibliometric analysis of the past decade's literature. J Cardiothorac Surg 2024; 19: 428.
2. TUKMOS. Göğüs Cerrahisi Uzmanlık Eğitimi Çekirdek Müfredatı: Tıpta Uzmanlık Kurulu; 2016 [updated 05.05.2016; cited 2024 Jul 1]. Available from: https://dosyamerkez.saglik.gov.tr/Eklenti/14481/0/goguscerrahisimufredatv21pdf.pdf.
3. Crawford FA Jr. Thoracic surgery education: past, present, and future. Ann Thorac Surg 2005; 79: S2232-S7.
4. Akçam Tİ, Çağırıcı U, Çakan A, Turhan K, Özdil A. Göğüs cerrahisi asistanları cerrahi eğitimleri konusunda ne düşünüyor? Turk Thorac Cardiovasc Surg J 2012; 20: 107-10.
5. Association of American Medical Colleges. FACTS: applicants, matriculants, enrollment, graduates, MD-PhD, and residency applicants data. 2018.
6. Yılmaz N, Alkan A, Ertümer AG, Kuh Z. Tıpta uzmanlık alanlarının toplumsal cinsiyet açısından değerlendirilmesi. Cukurova Med J 2021; 46: 1257-66.
7. Ozyurt A, Hayran O, Sur H. Predictors of burnout and job satisfaction among Turkish physicians. J Assoc Physicians 2006; 99: 161-9.
8. Rosenberg T, Pace M. Burnout among mental health professionals: special considerations for the marriage and family therapist. J Marital Fam Ther 2006; 32: 87-99.

9. Buddeberg-Fischer B, Dietz C, Klaghofer R, Buddeberg C. Swiss residents' arguments for and against a career in medicine. BMC Health Serv Res 2006; 6: 1-9.

10. Moss PJ, Lambert TW, Goldacre MJ, Lee P. Reasons for considering leaving UK medicine: questionnaire study of junior doctors' comments. BMJ 2004; 329: 1263.

11. Çelik B, Canbaz S. Work-related strain and the prevalence of burnout syndrome in thoracic surgeons and residents in Türkiye. Curr Thorac Surg 2021; 6: 155-61.

12. Chappell D, Di Martino V. Violence at work. Geneva: International Labour Organization; 2006.

13. Xaplanteri P. Correlates of mobbing among medical residents in a university general hospital: the experience from Greece and review of literature [Internet]. Stress-Related Disorders. IntechOpen; 2022 [cited 2024 Jan 7]. Available from: http://dx.doi.org/10.5772/intechopen.104041.

14. Bertizlioğlu O. Türkiye'de çocuk ve ergen ruh sağlığı ve hastalıkları eğitiminin uzman gözünden değerlendirmesi ve mobbing algısı. Gevher Nesibe J Med Health Sci 2022; 7: 121-30.

15. Çiçek C, Terzi C. Tıpta uzmanlık eğitimi (İzmir ölçekli iki araştırma ve karşılaştırmalı sonuçları). Ankara: Türk Tabipleri Birliği Yayınları; 2006. p. 1-132.

16. Çıtak N. The perspective of thoracic surgery and cardiovascular surgery residents in Türkiye on the situation of medical training programs and institutions. Turk Thorac Cardiovasc Surg J 2012; 20: 299-305.

17. Kim MP, Nguyen DT, Meisenbach LM, Graviss EA, Chan EY. Da Vinci Xi robot decreases the number of thoracotomy cases in pulmonary resection. J Thorac Dis 2019; 11: 145-50.

18. Oparka J, Yan TD, Ryan E, Dunning J. Does video-assisted thoracic surgery provide a safe alternative to conventional techniques in patients with limited pulmonary function who are otherwise suitable for lung resection? Interact Cardiovasc Thorac Surg 2013; 17: 159-62.

19. Coyan GN, Aranda-Michel E, Kilic A, Luketich JD, Okusanya O, Chu D et al. The impact of COVID-19 on thoracic surgery residency programs in the US: a program director survey. J Card Surg 2020; 35: 3443-8.

20. Daniel SJ. Education and the COVID-19 pandemic. Prospects 2020; 49: 91-6.

21. Aydan S. Hekim göçü açısından Türkiye'nin çalışma koşullarının değerlendirilmesi. Hacet Saglik Idaresi Derg 2023; 26: 895-920.

22. Kaya AE, Aktürk BE, Aslan E. Factors predicting the motivation to study abroad in Turkish medical students: a causal investigation into the problem of brain drain. J Health Sci Med 2023; 6: 526-30.

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Original Article

Impact of subclinical hypothyroidism on postoperative satisfaction in hyperhydrosis surgery

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ABSTRACT

Background: We aimed to study the effects of subclinical hypothyroidism on patient satisfaction after hyperhidrosis surgery.

Materials and Methods: Patients who underwent primary hyperhidrosis surgery from February 2013 to January 2017 were retrospectively evaluated and divided into two groups: Group 1 with normal thyroid function and Group 2 with subclinical hypothyroidism. All patients completed a postoperative satisfaction questionnaire on a 5-point Likert scale, with Cronbach's Alpha reliability coefficients of 0.93 preoperatively and 0.96 postoperatively. The questionnaire assessed satisfaction differences between groups in daily life following surgery.

Results: A total of 82 patients aged 18-65 and met Hornberger's criteria were evaluated in the study. Patient satisfaction rate was 80.5% for the overall population. Although the difference between preoperative and postoperative state was statistically significant (Greenhouse-Geisser; $p < 0.0001$), no statistically significant difference was found in postoperative satisfaction between Group 1 and Group 2. ($p = 0.13$).

Conclusions: Subclinical hypothyroidism does not impact the outcomes of endoscopic thoracic sympathectomy; thus, patients with this condition can safely undergo the procedure based on this study's findings.

Keywords: hyperhidrosis, subclinical hypothyroidism, postoperative satisfaction, analysis, questionnaire

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Introduction

Sweating is a part of the thermoregulatory system. Hyperhidrosis is defined as excessive sweating and eccrine sweat glands working more than normal [1,2]. The most common form is primary hyperhidrosis and its clinical presentation is mostly localized as palmoplantar, axillary and facial in order of frequency [3]. Its exact incidence is not known, but it is thought to affect 0.6 to 2.8% of the population [4].

Topical and systemic medical therapies can be used in the treatment as well as options such as iontophoresis and Botox, but surgical treatment is the gold standard [5,6].

Thyroid disorders, a common cause of secondary hyperhidrosis, should also be considered in cases of subclinical variants. Overt thyroid disorders can clearly cause secondary hyperhidrosis, and asymptomatic subclinical thyroid diseases may lead to unexpected skin conditions related to a flawed thermoregulatory system, potentially resulting in undesirable surgical outcomes [7]. In this study, we examined the relationship between subclinical hypothyroidism and its potential impact on hyperhidrosis surgery.

Subclinical hypothyroidism is a condition characterized by mildly elevated thyroid-stimulating hormone (TSH) levels while serum triiodothyronine (T3) and thyroxine (T4) levels remain within the normal range, and it is asymptomatic. The European Thyroid Association (ETA) guidelines for managing subclinical hypothyroidism were published nearly a decade ago, yet they remain valid, as the rationale for intervention - based on the patient's age, serum TSH levels, symptoms, and comorbidities - continues to be relevant today [8,9].

The impact of subclinical hypothyroidism on postoperative outcomes has been studied across various surgical specialties, but there is insufficient data regarding its effects on hyperhidrosis surgery. Although the association of hyperhidrosis and hyperthyroidism has been widely investigated, the relationship between hyperhidrosis surgery results and TSH levels has not been investigated before.

Materials and Methods

Patient Characteristics and Data Collection

The study aimed to evaluate the link between hyperhidrosis and subclinical hypothyroidism regarding the patients' overall postoperative satisfaction. This multisurgeon single-center retrospective study included all patients who underwent endoscopic thoracic sympathectomy between February 2013 and January 2017 in our hospital. The data of 82 patients who met Hornberger's criteria [10] were analyzed in this study. The exclusion criteria were: 1) being out of the 18-65 age span, 2) abnormal preoperative TSH values, and 3) indications other than hyperhidrosis for surgery.

Patients were divided into two groups according to The American Association of Clinical Endocrinologists and The American Thyroid Association (ATA/AACE) Guidelines for Hypothyroidism in Adults which involves the TSH upper limit of The National Academy of Clinical Biochemistry (NACB) [8] as shown in Table 1. Group 1 was the patients with normal thyroid functions and Group 2 was the patients with subclinical hypothyroidism.

Table 1. TSH upper normal levels according to different study or society groups.

Group, study, society	TSH upper normal
NACB	2.5
NHANES III, disease free	4.5
NHANES III, reference population	4.12

Preoperative TSH values of the patients were evaluated within the framework of the reference range of the biochemistry department of our hospital. Demographic information and hospital records such as operation reports were completely available for in-hospital study variables. Patients were contacted by phone or face-to-face between January 3, 2018 and January 9, 2018, and a web-based (Google® Forms) questionnaire was administered (Figure 1), and the survey results were recorded. The questionnaire utilized in this study was adapted from the publication titled 'Questionnaire of Quality of Life in Patients with Primary Hyperhidrosis' [11]. It employs a 5-point Likert scale, with the instrument's reliability confirmed by Cronbach's Alpha coefficients of 0.93 before surgery and 0.96 after surgery, indicating a high level of reliability. The Institutional Ethical Committee approved the study protocol (HNEAH-KAEK 2017/551). The study conformed to the principles of the Declaration of Helsinki.

PATIENT SATISFACTION QUESTINNAIRE

Name: Birth place and date: Gender: M ( ) F ( )

CLINICAL DATA

1. Location of hyperhidrosis :
( ) Axillary ( ) Palmar ( ) Plantar ( ) Craniofacial
2. Postoperative time in months :
( ) Less than 12 months ( ) More than 12 months
3. Compensatory hyperhidrosis :
( ) Yes ( ) No
4. In case of compensatory hyperhidrosis, it is :
( ) Acceptable ( ) Disturbing ( ) Debilitating
5. How satisfied were you with the operation? :
( ) Unsatisfied ( ) Regularly satisfied ( ) Satisfied ( ) Very satisfied

GENERAL QUESTIONS

1. How would you rate your quality of life before surgery?
Excellent – 1 Very good – 2 Good – 3 Poor – 4 Very Poor– 5
2. How would you rate your quality of life at least 30 days after surgery?
Much better – 1 Slightly better – 2 Same – 3 Slightly worse – 4 Much worse – 5

COMPARED TO THE PERIOD BEFORE SURGERY

1. With relation to the following items, how would you rate your quality of life? (FUNCTIONAL)

	BEFORE SURGERY	AFTER SURGERY
Writing	1 2 3 4 5	1 2 3 4 5
Manual work	1 2 3 4 5	1 2 3 4 5
Leisure	1 2 3 4 5	1 2 3 4 5
Sports	1 2 3 4 5	1 2 3 4 5
Hand shaking	1 2 3 4 5	1 2 3 4 5
Socializing	1 2 3 4 5	1 2 3 4 5
Grasping objects	1 2 3 4 5	1 2 3 4 5
Social dancing	1 2 3 4 5	1 2 3 4 5

2. With your partner / spouse, how would you rate your quality of life? (PERSONAL)

	BEFORE SURGERY	AFTER SURGERY
Holding hands	1 2 3 4 5	1 2 3 4 5
Intimate touching	1 2 3 4 5	1 2 3 4 5
Intimate affairs	1 2 3 4 5	1 2 3 4 5

3. How would you rate the fact that after sweating/blushing excessively (EMOTIONAL-SELF or OTHERS)

	BEFORE SURGERY	AFTER SURGERY
I always justified myself	1 2 3 4 5	1 2 3 4 5
People rejected me slightly	1 2 3 4 5	1 2 3 4 5

4. Under special circumstances, how would you rate your quality of life?

	BEFORE SURGERY	AFTER SURGERY
In a closed or hot environment	1 2 3 4 5	1 2 3 4 5
When tense or worried	1 2 3 4 5	1 2 3 4 5
Thinking about a problem	1 2 3 4 5	1 2 3 4 5
Before an examination / meeting / speaking in public	1 2 3 4 5	1 2 3 4 5
Wearing sandals / walking barefoot	1 2 3 4 5	1 2 3 4 5
Wearing colored clothing	1 2 3 4 5	1 2 3 4 5
Having problems at school / work	1 2 3 4 5	1 2 3 4 5
TOTAL SCORE	[ ]	[ ]

Figure 1. Patient satisfaction questionnaire.

Surgical Technique

All operations were performed with video-assisted thoracoscopic surgery (VATS) technique. The patients underwent double lumen intubation after appropriate premedication. First the right and then left sympathetic nerves intervened. The operations were performed with a 5 mm angle-free video thoracoscope (Olympus®), and the flat or horizontal endo-clip was used according to the anatomical course and position of the sympathetic nerve (Covidien® Endo Clip Auto Suture™).

All cases were performed using biportal VATS. Incisions were made at the 3rd and 5th intercostal spaces. Carbon dioxide insufflation was not used during videothoracoscopic exploration, as double-lumen intubation provided sufficient exposure. The sympathetic chain was identified through exploration and dissected from the surrounding pleural tissue. Continuity of the sympathetic chain was then interrupted with the application of metallic clips. The inner surface of the corresponding rib was cauterized to prevent conduction through potential alternative pathways (Kuntz nerve). Hemostasis was ensured, free air in the intrathoracic space was aspirated, and incisions were closed without placement of a chest drain after positive pressure ventilation.

Statistical Analysis

IBM® SPSS® Statistics 26.0 was used to analyze the data and Microsoft® Office™ Excel™ was used to form graphics. In analyzing the research data, descriptive statistics (frequency distributions, mean, standard deviation) were utilized, and the Kolmogorov-Smirnov test was applied to assess normality distribution. Two-way analysis of variance (subgroup analysis; Greenhouse-Geisser), Chi-Square test and T-Test were used for repeated measurements. The results were evaluated at a 95% confidence interval and $p < 0.05$ significance level.

Results

The survey results of 82 patients included in the study were examined. The distribution of the data is in Table 2 and the graphical representation is in Figure 2.

Table 2. Satisfaction survey distribution.

Operation	Mean	Standard Deviation	Min.-max.
Before	82.34	12.92	48.00-100.00
After	37.34	1652	20.00-98.00

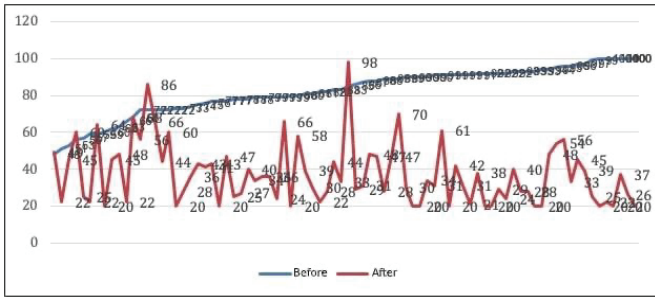

Figure 2. Graphical representation of satisfaction survey. (Note: The numbers above represent the scores obtained by the patients based on their responses in the survey. As the score increases, satisfaction decreases, whereas satisfaction increases as the score decreases).

Group 1 (89%) of 73 euthyroid patients and Group 2 (11%) of 9 patients with subclinical hypothyroidism were statistically compared in terms of hyperhidrosis region, presence of compensatory hyperhidrosis (CH), acceptability of CH and degrees of satisfaction. 16 out of 73 patients in Group 1 were dissatisfied with the surgical outcome, while no patients in Group 2 expressed dissatisfaction. However, this difference was not statistically significant ($p = 0.13$).

The effect of the survey results on patient groups was investigated by two-way analysis of variance in re-

peated measurements. The average score of 73 patients in Group 1 before the surgery was 81.86 ± 13.7 and after the surgery it was 37.85 ± 17.03. The average score of 9 patients in Group 2 before the surgery was 86.22 ± 9.35 and after the surgery it was 33.22 ± 11.45. The difference between before and after surgery was statistically significant (Greenhouse-Geisser test; $p < 0.0001$) however, the effect of patient groups was not significant (Greenhouse-Geisser test; $p = 0.27$).

Discussion

Sweat glands are primarily regulated by cholinergic innervation [12], which typically stimulates sweat production through acetylcholine release. However, these glands can also respond to adrenergic agents, which trigger sweating through the adrenergic (sympathetic) pathway. This adrenergic stimulation can be blocked by both types of receptor-blocking drugs, specifically by using drugs that inhibit beta (β) receptors, such as propranolol, or alpha (α) receptors, which are part of the sympathetic nervous system. This dual control highlights the complexity of sweat gland regulation under different physiological conditions, such as stress or increased metabolism associated with hyperthyroidism.

In hyperthyroidism, hyperhidrosis likely results from an elevated metabolic rate. Excessive sweating and accompanying cardiovascular symptoms are reduced with propranolol administration. However, although propranolol effectively diminishes sweat production triggered by sympathetic activation, it has no effect on individuals without hyperhidrosis or hyperthyroidism when exposed to a hot environment [13].

Our study was based on the hypothesis that, just as overactivity of the thyroid gland can fundamentally affect the thermoregulatory system, underactivity might also disrupt this balance. The results of our research concluded that subclinical hypothyroidism does not influence the outcomes of ETS.

According to Park et al, patients with subclinical hypothyroidism had a higher risk of developing AF in the postoperative period [14]. Kong et al reported that preoperative subclinical hypothyroidism is associated with less favorable cardiovascular outcomes, especially coronary revascularization after bypass surgery [15]. In Comendador et al's study of 467 cases, postoperative atrial fibrillation occurred in 57% of patients with subclinical hypothyroidism versus 30.3% in those without [16]. Blonna et al reported that subclinical hypothyroidism posed a significant risk of dullness following arthroscopic shoulder surgery [17]. Zhao et al found that subclinical hypothyroidism was associated with an increased risk of mortality [18]. Kim et al found that subclinical hypothyroidism had no effect on bone healing [19]. Komatsu et al revealed that hypothyroid patients had slightly longer length of stay in the hospital [20]. Gonzalez-Navarro et al reported that subclinical hypothyroidism was associated with slower postoperative functional recovery in their knee arthroplasty study [21]. Jing et al found that subclinical hypothyroidism increased the incidences of both medical and surgical complications following primary total knee arthroplasty [22]. Kovar et al found that subclinical hypothyroidism could be an independent risk factor for both vascular and overall mortality.

In our study, subclinical hypothyroidism was found not to contribute to the development of atrial fibrillation (AF), nor did it negatively affect postoperative recovery or hospital length of stay. Additionally, subclinical hypothyroidism was not associated with an increased mortality risk or a higher overall complication rate.

When considering other factors affecting sympathectomy, a prospective study by Dias et al examined the relationship between CH, anxiety, depression, and quality of life in patients undergoing thoracoscopic sympathectomy [23]. The study followed 54 patients over 180 days, showing that 93% experienced significant improvements in their quality of life after surgery, although the intensity of CH was strongly correlated with anxiety levels. Despite CH being present in most patients, anxiety did not diminish overall satisfaction with the procedure. In our study, subclinical hypothyroidism was found to have no impact on CH outcomes.

Another key consideration is the anatomical variation in thoracic sympathetic ganglia, as explored by Pei et al [24]. Their research involving 695 patients revealed that anatomical variations, particularly in the third and fourth sympathetic ganglia, influenced both the effectiveness of the surgery and the incidence of CH. While real T3 sympathicotomy was more effective for treating palmar hyperhidrosis, real T4 sympathicotomy was associated with lower rates of moderate-to-severe CH, especially in the chest and back. These findings suggest that preop-

erative imaging and a customized surgical approach may enhance outcomes by accounting for these anatomical differences. However, in our study, we found that underlying thyroid disorders detected through preoperative TSH evaluations had no effect on surgical outcomes.

Finally, Minqiang et al conducted a randomized controlled trial comparing traditional opioid-based anesthesia with opioid-reduced multimodal anesthesia in patients undergoing thoracoscopic sympathectomy [25]. The study found no significant differences in perioperative complications, postoperative pain levels, or patient satisfaction between the two groups. Similarly, in our study, subclinical thyroid disorders had no effect on these parameters.

Limitations

Although no studies in the literature have evaluated the relationship between subtly lowered thyroid function and hyperhidrosis, which was the foundation of our initial hypothesis for this study, we encountered certain limitations. According to the ATA/AACE Guidelines for Hypothyroidism's Adults guideline published by Garber et al in 2012, subclinical hypothyroidism is defined as a combination of normal sT4 level and TSH above the reference limit, but the ongoing discussion of the TSH reference limit is also mentioned [8]. According to the said guide, the TSH reference limit was specified as 4.12 mIU/L by National Center for Health Statistics (NHANES) III, while it was specified as 2.5 mIU/L according to The National Academy of Clinical Biochemistry (NACB) data [8]. In our study, we accepted the upper limit of TSH as 2.5 mIU/L in accordance with NACB data. We classified TSH values above this limit as subclinical hypothyroidism. However, as we mentioned above, there are contradictions regarding this issue in the literature. Another limitation is that, due to the retrospective nature of our study and the relatively small number of patients, we may not have detected any potential differences between the two groups. Therefore, we suggest that large, multicenter studies are needed to further clarify this issue.

In conclusion, our study concluded that subclinical hypothyroidism does not affect the outcomes of endoscopic thoracic sympathectomy. Based on this finding, it can be stated that the presence of subclinical hypothyroidism does not pose a barrier to performing the procedure, nor does it lead to an increased rate of complications. Nevertheless, further research with larger case series is necessary to validate our results. Consequently, our study represents the first of its kind on this topic, and we believe it may serve as an inspiration for future research.

Declaration of conflicting interests

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Ethics approval

The study was approved by The Institutional Ethical Committee of Yedikule Pulmonology and Thoracic Surgery Hospital (HNEAH-KAEK 2017/551).

Authors' contributions

ÖY; designed the study, collected, and analyzed the patient data, wrote the paper, EÇ; collected the patient data, reviewed the literature, NY; revised the final version of the study. All authors read and approved the final manuscript.

References

1. Leung AK, Chan PY, Choi MC. Hyperhidrosis. Int J Dermatol 1999; 38: 561-7.
2. Önder M, Aksoy G. Hiperhidroz. Türkderm 2011; 45: 2-9.
3. Apilioğulları B, Bilgiç Ö. Hiperhidroz tedavisi. Genel Tıp Derg 2014; 24: 79-84.
4. Schick CH. Pathophysiology of Hyperhidrosis. Thorac Surg Clin 2016; 26: 389-93.
5. Garcia Franco CE, Perez-Cajaraville J, Guillen-Grima F, España A. Prospective study of percutaneous radiofrequency sympathicolysis in severe hyperhidrosis and facial blushing: Efficacy and safety findings. Eur J Cardiothorac Surg 2011; 40: 146-51.
6. Macía I, Moya J, Ramos R, Rivas F, Ureña A, Rosado et al. Primary hyperhidrosis. Current status of surgical treatment. Cir Esp 2010; 88: 146-51.
7. Lause M, Kamboj A, Fernandez Faith E. Dermatologic manifestations of endocrine disorders. Transl Pediatr 2017; 6: 300-12.
8. Garber JR, Cobin RH, Gharib H, Hennessey JV, Klein I, Mechanick JI, et al; American Association of Clinical Endocrinologists and American Thyroid Association Taskforce on Hypothyroidism in Adults. Clinical practice guidelines for hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. Endocr Pract 2012; 18: 988-1028.

9. Jing W, Long G, Yan Z, Ping Y, Mingsheng T. Subclinical Hypothyroidism Affects Postoperative Outcome of Patients Undergoing Total Knee Arthroplasty. Orthop Surg 2021; 13: 932-41.

10. Dias LI, Miranda EC, Toro IF, Mussi RK. Relationship between anxiety, depression and quality of life with the intensity of reflex sweating after thoracoscopic sympathectomy for treatment of primary hyperhidrosis. Rev Col Bras Cir 2016; 43: 354-9.

11. Pei G, Meng S, Yang Y, Wang X, Liu Q, Wang S, Huang Y. Anatomical variations of the thoracic sympathetic ganglions and their effects on sympathicotomy for primary palmar hyperhidrosis. Clin Auton Res 2023; 33: 111-20.

12. Minqiang L, Mingfei M, Fengzhu H, Yang L, Shanshan G, Qinlang S et al. Assessing the clinical advantage of opioid-reduced anesthesia in thoracoscopic sympathectomy: a prospective randomized controlled trial. BMC Anesthesiol 2024 12; 24: 325.

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Case Report

A rare reason for intubation: esophageal foreign body lodged in the upper esophageal stricture

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ABSTRACT

Esophageal foreign bodies are more common in children than in adults. However, in older individuals without teeth, food swallowed without thorough mastication can get lodged in the esophagus. Herein, we report the case of a 77-year-old woman who presented with severe dyspnea, dysphagia, and a globus sensation in her throat. The patient required intubation owing to progressive dyspnea and rapid peripheral saturation decrease and was found to have a foreign body lodged in her proximal esophagus, which was removed using McGill forceps under direct visualization. Subsequently, the patient was extubated and transferred to the ward. Complaints of dysphagia in older patients with mastication problems should prompt clinicians to consider foreign body impaction. The proximal esophagus is the most common site for foreign body entrapment. If left unmanaged, foreign bodies lodged in the upper gastrointestinal tract can cause serious life-threatening conditions. Appropriate diagnosis and treatment can help minimize potential risks.

Keywords: esophageal foreign bodies, difficult intubation, management, airways, surgery.

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Introduction

Esophageal foreign bodies (EFBs) are among the most common emergency cases that can be easily treated with complete recovery and no complications via early diagnosis and treatment. The esophagus is the narrowest part of the upper gastrointestinal tract and is the most common site for foreign body entrapment. Foreign body ingestion occurs more frequently in children than in adults [1]. The foreign bodies ingested by adults usually include sharp-edged objects, such as bone fragments, meat with bones, and cartilage, whereas those ingested by children are more likely to include rounded objects, such as metal coins and batteries. Previous studies have reported that food entrapment caused by unchewed food is more common in adults than in children [2]. Herein, we reported the case of a patient who presented to the emergency department (ED) with severe dyspnea, dysphagia, and a globus sensation in her throat due to a piece of red meat lodged in her proximal esophagus.

Case Report

A 77-year-old woman presented to the ED with complaints of coughing, dyspnea, and dysphagia that started while eating. At the time of investigation, the patient was experiencing difficulty in breathing. Patient history collected by the ED physician revealed a suspicion of EFB, prompting the medical team to perform the Heimlich maneuver on the patient. However, this intervention failed to extract any foreign body from the patient's mouth and led to a gradual decrease in her peripheral saturation to 60% and blue discoloration of her face, requiring rapid intubation. On physical examination after the intubation, the bilateral breath sounds were equal and normal. The patient underwent chest computed tomography (CT), which showed the intubation tube in the trachea and a large lesion resembling soft tissue measuring 8 x 5 cm behind the trachea at the right side of the midline (Figure 1a). The lesion appeared to compress the trachea and shift it forward. After receiving a request for consultation, we performed a clinical examination, reviewed the investigation results, and assessed the oral cavity of the patient with the help of a laryngoscope at bedside in the ED. A foreign body was observed at the site of the esophageal entry and was subsequently extracted using Magill forceps (Figure 1b). Then, esophagoscopy was performed to assess the esophageal lumen, which showed no other foreign bodies. Subsequently, a bronchoscopy was scheduled to rule out the suspicion of a foreign body in the trachea and the patient was extubated. The patient underwent tracheal and main bronchi assessment using a rigid bronchoscope in the ED. On the absence of foreign bodies in the airway, the patient was awakened and transferred to the ward. There was no postoperative complication and the patient was discharged the following day. Written informed consent was obtained from the patient and legally responsible kin of the patient, for publication.

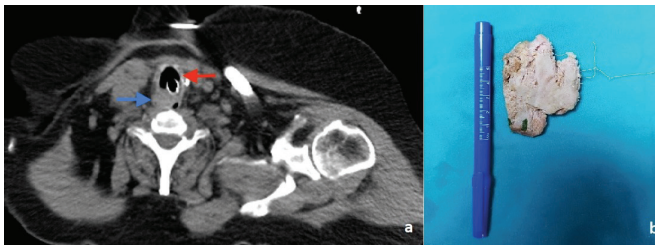

Figure 1. In the lung computed tomography (CT), there was an intubation tube in the trachea and a soft tissue-like lesion measuring 8x5 cm in the right midline of the trachea (a), foreign body removed from the esophagus with the help of Magill forceps (b).

Discussion

Although EFBs can be encountered in all age groups, they are more frequent in children. However, foreign body ingestion in older individuals is associated with a higher risk of morbidity and mortality [2]. Among foreign body entrapment cases, 87% occurs in the upper esophageal stricture and 13% occurs the middle esophageal stricture, with the lower esophageal stricture being very rarely involved [3]. Most EFBs get lodged at the level of the cricopharyngeus muscle [4]. The most common symptoms associated with EFBs include neck pain, dysphagia, sticking and stinging sensation, hypersalivation, and esophageal obstruction–induced tracheal aspiration [5]. Patient anamnesis is essential for diagnosing EFBs, and its lack can delay the diagnosis [6]. Late diagnosis makes treatment harder and may cause serious and life-threatening complications. Thus, foreign body ingestion requires swift and appropriate diagnosis and treatment [3]. CT helps pinpoint the location of the foreign body and reduce the risk of complications by allowing the removal of the foreign body in a timely manner and is reportedly the preferred imaging modality for the early diagnosis of EFBs [5].

As early diagnosis and treatment enables patients to recover without complications and late diagnosis ren-

ders treatment more difficult, the first 24 hours are critical, highlighting the importance of prompt measures in EFB cases [5,7]. Missed diagnosis or delay in managing this condition can lead to critical and life-threatening consequences, particularly including esophageal rupture, which can cause mediastinitis, abscess, fistula, empyema, sepsis, and death [8]. Another life-threatening complication, as was observed in our patient, occurs when the foreign body compresses the posterior membranous wall of the trachea, jeopardizing the airway and causing tracheal collapse. This is often caused by a foreign body lodged in the upper esophageal stricture. The Heimlich maneuver, which is one of the methods used when a foreign body obstructs the airway, may also have some undesirable results. The most common complications are rib fractures and pneumomediastinum [9]. We must remember that performing the maneuver incorrectly or using excessive force can have potentially life-threatening consequences. Foreign bodies closer to the oral cavity are usually easier to remove with the help of instruments such as McGill forceps. However, foreign bodies are more suitable for removal by rigid esophagoscopy, which is carefully performed by experienced physicians under general anesthesia and minimizes the possibility of complications [10].

EFBs are among the most common emergency cases. Foreign bodies entrapped in the upper esophageal stricture can compress the posterior wall of the trachea, causing respiratory failure. In such cases, swift and appropriate diagnosis and treatment can help prevent mortality.

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Authors' contributions

OT,AB,EST,SK: have given substantial contributions to the literature search, data collection, study design, analysis of data, manuscript preparation, analysis interpretation of the data and review of manuscript, OT, SK: revised it critically. All authors have participated to drafting the manuscript, All authors read and approved the final version of the manuscript.

References

1. Kim JK, Kim SS, Kim JI, Kim SW, Yang YS, Cho SH et al. Management of foreign bodies in the gastrointestinal tract: an analysis of 104 cases in children. Endoscopy 1999; 31: 302-4.
2. Nandi P, Ong GB. Foreign body in the oesophagus: review of 2394 cases. Br J Surg 1978; 65: 5-9.
3. İnci İ, Özçelik C, Ülkü R, Eren N. Özofagus yabancı cisimleri: 682 olgunun incelenmesi. Turk Gogus Kalp Dama 1999; 7: 148-52.
4. Uyanıkoğlu A, Sert U, Sert H, Cindoğlu Ç. Yaşlı hastalarda servikal özofagustan yabancı cisim çıkarılması: 2 olgu sunumu. Endoskopi Gastrointestinal 2015; 23: 89-92.
5. O'Sullivan ST, McGreal GT, Reardon CM, Hehir DJ, Kirwan WO, Brady MP. Selective endoscopy in management of ingested foreign bodies of the upper gastrointestinal tract: is it safe? Int J Clin Pract 1997; 51: 289-92.
6. Chiu YH, Hou SK, Chen SC, How CK, Lam C, Kao WF et al. Diagnosis and endoscopic management of upper gastrointestinal foreign bodies. Am J Med Sci 2012; 343: 192-5.
7. Topaloğlu Ö, Akdoğan A, Karapolat S, Türkyılmaz A. A rare case of esophageal foreign bodies. Turk Gogus Kalp Dama 2022; 30: 136-7.
8. Erbil B, Karaca MA, Aslaner MA, İbrahimov Z, Kunt MM, Akpinar E, et al. Emergency admissions due to swallowed foreign bodies in adults. World J Gastroenterol 2013;19: 6447-52.
9. Kleytman N, Satoskar S, Riera Gonzalez C, Tedla A, John N, Thite S et al. Gastric Rupture Secondary to a Heimlich Maneuver: A Case Report. Cureus 2024; 16: e66466.
10. Topaloglu O, Kılıc Nur K, Karapolat S, Aydın Y, Turkyilmaz A, Sengul Taslak A et al. Diagnosis, treatment, and management of esophageal foreign bodies in patients with mental retardation: A retrospective study from three centers. Turk Gogus Kalp Dama 2024; 32: 179-84.

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How to do it

A method in difficult to sample mediastinal lymph nodes: the needle dissection technique

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ABSTRACT

Background: The diagnostic reach of mediastinoscopy depends on adequate tissue sampling. However, adequate tissue sampling may not be possible with conventional blunt dissection methods, especially in the presence of thick encapsulated mediastinal lymph nodes or a mass. It reduces the diagnostic success of mediastinoscopy, and patients may therefore easily result in misdiagnosis. Here, we present a new sharp dissection technique, which we use in cases where adequate tissue sampling from the mediastinal lymph nodes is essential and blunt dissection does not provide it.

Materials and Methods: Between 2016-2022, we performed mediastinoscopy in 298 patients and analysed retrospectively. Biopsy could not be taken from mediastinal lymph node and/or mediastinal mass by conventional methods in 26 patients (8.7%). While biopsy could be taken with surgical instruments developed for other operations in 14 of these patients, the needle dissection technique was performed in the remaining 12 patients who cannot be taken a biopsy with conventional and/or surgical instruments developed for other operations.

Results: In patients who needed this technique in mediastinoscopy, all of the tissue with diagnostic value was sampled, no complications were observed, and the most common diagnosis was tuberculosis (n = 8, 66.6%).

Conclusions: The use of surgical instruments developed for other operations such as long and thin aspirator and forceps, endoscopic scissors, injection needle and endoclips in addition to standard surgical instruments in mediastinoscopy and also performing this needle dissection technique may increase the diagnostic success of mediastinoscopy.

Keywords: mediastinoscopy, lymph node sampling, sharp dissection

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Introduction

A variety of techniques are available for a mediastinal nodal and/or mass evaluation including tissue sampling. Mediastinoscopy is an effective method in the investigation of diseases with mediastinal lymphadenopathy or those localized in the mediastinum especially in patients who cannot be diagnosed with noninvasive techniques [1,2]. However, it should be noted that the success of mediastinoscopy is directly correlated to the amount of pathological material harvested. It was indicated that between 2% and 10% of the patients who had a mediastinal disease could not be diagnosed by mediastinoscopy [2]. The factors negatively affecting the success may be the presence of encapsulated mediastinal lymph nodes, therefore sampling can be difficult. Lazzaro and LoCicero stated that endoscopic scissors, endo dissectors and endoclips were additionally used during mediastinal lymph node sampling [3]. When necessary, surgical instruments developed for other operations such as energy devices, endoscopic scissors and forceps supported injection needle can be used through the videomediastinoscope [4]. In this study, we describe a new method in order to increase the amount of tissue harvested which can be used in both video-assisted and conventional mediastinoscopy.

Materials and methods

Between 2016-2022, we performed mediastinoscopy in 298 patients who cannot be diagnosed with noninvasive techniques, and analysed retrospectively. The mediastinal lymph node can neither be dissected with aspirators nor sampled with forceps due to the thickness of its capsule is included in the study.

Technique

Blunt dissection to lymph nodes with thick capsules is generally ineffective. Therefore, 5-6 holes are made with the injection needle placed at the tip of the forceps in the most suitable part of the capsule for sampling (Figure 1A). These holes should be drilled in different places at intervals of about 1 millimeter, thereby weakening the capsule. Then, the capsule is cut slowly by making sharp dissection to the weakened capsule with the lower end of the endoscopic scissors (Figure 1B). The same procedure is repeated at 30 degrees apical and the triangular capsule flap is raised (Figure 1C). All cases were performed by a single surgeon.

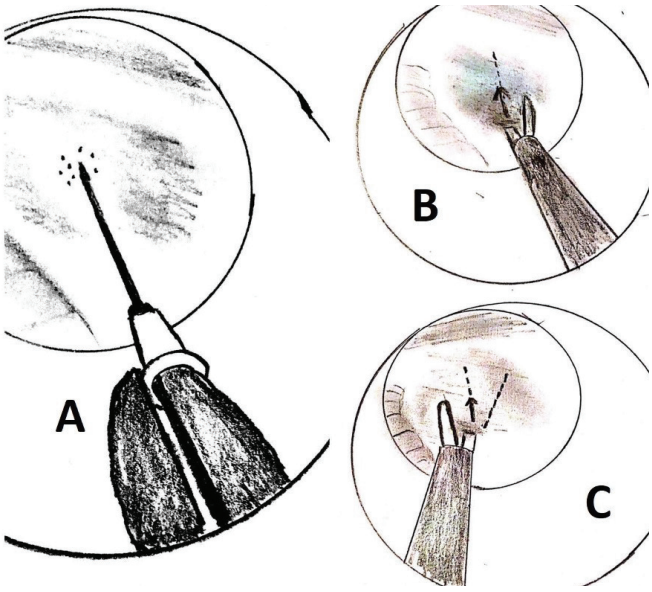

Figure 1. The illustration shows the needle punctures (A), sharp dissection of capsule (B, C).

Results

Biopsy could not be taken from mediastinal lymph node and/or mediastinal mass by conventional method in 26 patients (8.7%). While biopsy could be taken with surgical instruments developed for other operations in 14 of these patients, the needle dissection technique was performed in the remaining 12 patients who cannot be taken a biopsy with conventional and/or surgical instruments developed for other operations. In patients who needed this technique in mediastinoscopy, all of the tissue with diagnostic value was sampled, no complications were observed, and the most common diagnosis was tuberculosis (n = 8, 66.6%). Diagnosis determined using the needle dissection technique shown in table 1.

Table 1. Diagnoses determined using the needle dissection technique.

Diagnosis	n=12
Tuberculous lymphadenitis	8
Anthracosis	2
Lymphoma	1
Small cell carcinoma	1

Comment

In many diseases, especially in the differential diagnosis of granulomatous diseases, a large amount of histological material may be required. This results in noninvasive techniques being insufficient for the diagnosis of granulomatous diseases [5]. Another problem arising from this situation is that tuberculosis, a type of gran-

ulomatous disease, causes technical difficulties in the operations of some patients. The link between fibrosing mediastinitis that is thickening of the fibrous tissue in the mediastinum and tuberculosis has been documented [6]. This may explain why tuberculous mediastinal lymphadenitis has a hard capsule. In this respect, the rigidity of the capsule in benign lesions suggests that it is a sign of tuberculosis disease, and therefore, this issue should be further investigated.

It has been stated that 1% of patients could not be diagnosed during mediastinoscopy, and some patients with tuberculosis could actually get wrong diagnosis [7]. The failure to diagnose tuberculosis or the misdiagnosing a potential case of tuberculosis as another disease infers will cause both social and individual problems. If our technique had not been used in these patients, they would have been deprived of treatment, and they would easily be misdiagnosed. Therefore, it can be considered that the use of surgical instruments developed for other operations and this needle dissection technique will increase the diagnostic power of mediastinoscopy. Complications such as massive hemorrhage and hoarseness were not seen in cases where our technique were used, thus, it can be performed safely when it is necessary, with no extra costs incurred.

In conclusion, the use of surgical instruments developed for other operations such as long and thin aspirator and forceps, endoscopic scissors, injection needle and endoclips in addition to standard surgical instruments in mediastinoscopy and also performing this needle dissection technique may increase the diagnostic success of mediastinoscopy.

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Authors' contributions

KK,UK: conceived and designed this study, contributed to data collection, analyses and interpretation, co-wrote the study. All authors have read and approved the final manuscript.

References

1. Cheng G, Mahajan A, Oh S, Benzaquen S, Chen A. Endobronchial ultrasound-guided intranodal forceps biopsy (EBUS-IFB)-technical review. J Thorac Dis 2019; 11: 4049-58.
2. Yazgan S, Ucvet A, Gursoy S, Ceylan KC, Yıldırım Ş. Surgical Experience of Video-Assisted Mediastinoscopy for Nonlung Cancer Diseases. Thorac Cardiovasc Surg 2021; 69: 189-93.
3. Lazzaro RS, LoCicero J. Transcervical Mediastinal Lymph Node Sampling and Lymphadenectomy, Transcervical Mediastinal Lymph Node Sampling and Lymphadenectomy, General Thoracic Surgery, 7th Edition, Chapter 169. Eds: Shields TW, LoCicero J; Reed CE, Feins RH. 2009 Lippincott Williams & Wilkins.
4. Özdemir S, Sönmezoğlu Y, Aydoğmuş Ü, Cansever L, Kocatürk CI, Bedirhan MA. Is video-assisted mediastinoscopy superior than standard mediastinoscopy for mediastinal staging of the patients with lung cancer? Turk Gogus Kalp Dama 2015; 23: 683-9.
5. Onat S, Ates G, Avci A, Yildiz T, Birak A, Akgul Ozmen C, Ulku R. The role of mediastinoscopy in the diagnosis of non-lung cancer diseases. Ther Clin Risk Manag 2017; 13: 939-43.
6. Wu Z, Jarvis H, Howard LS, Wright C, Kon OM. Post-tuberculous fibrosing mediastinitis: a review of the literature. BMJ Open Respir Res 2017; 4: e000174.
7. McManus TE, Haydock DA, Alison PM, Kolbe J. Isolated mediastinal adenopathy: the case for mediastinoscopy. Ulster Med J 2008; 77: 97-101.

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Current Thoracic Surgery requires authors to submit a data-sharing statement form and register a data-sharing plan when registering a clinical trial. The ICMJE's data sharing statement policy asks authors to submit a data-sharing statement for randomized clinical trials. The ICMJE's policy regarding trial registration is explained at (http://www.icmje.org/icmje-recommendations.pdf).

Accordingly, the data sharing statements must indicate the following:

whether individual deidentified participant data (including data dictionaries) will be shared,

what data in particular will be shared,

whether additional, related documents will be available (e.g., study protocol, statistical analysis plan, etc.),

when the data will become available and for how long,

by what access criteria data will be shared (including with whom, for what types of analyses, and by what mechanism).

Authors must provide a data-sharing statement at submission to indicate whether data will be shared according to the statements written above.

Please visit http://www.icmje.org/icmje-recommendations.pdf that provides illustrative examples of data sharing statements that would meet these requirements.

Authors of secondary analyses using shared data must attest that their use was in accordance with the terms (if any) agreed to upon their receipt. They must also reference the source of the data using its unique, persistent identifier to provide appropriate credit to those who generated it and allow searching for the studies it has supported. Authors of secondary analyses must explain completely how theirs differ from previous analyses. In addition, those who generate and then share clinical trial data sets deserve substantial credit for their efforts. Those using data collected by others should seek collaboration with those who collected the data. As collaboration will not always be possible, practical, or desired, the efforts of those who generated the data must be recognized.

Statistical Knowledge

The statistical method used should be reported in a way that a reader whoever could reach the original data could understand the results. The terms used, abbreviations, symbols, the pc programme used and the statistical method should all be defined.

When reporting the results, especially when giving means and percentages, two digits should be given after the comma (112.20 or 112.21 instead of 112.2). P, t, Z values are exceptional and three digits should be given after the comma ($p = 0{,}001$, instead of $p < 0{,}05$).

Briefly, except whole numbers, two digits after the comma should be given, but for statistical values like p,t,z,F,Chi-square, three digits after the comma should be given. When presenting p values, the exact p value together with the test statistics should be given, except for the case when this value is smaller than one percent or one per thousand (this time $p < 0.01$ or $p < 0.001$, respectively should be given).

Preparation of Manuscript

Cover Letter

The Current Thoracic Surgery requires authors to disclose in the "cover letter" any commercial association (eg, employment, direct payments, stock holdings, retainers, consultantship, patent licensing arrangements, or honoraria) that might pose a conflict of interest issue concerning the manuscript. All funding sources supporting the work should be acknowledged in a footnote. Also authors should mention that none of the material in the manuscript has been published previously, and that none of this material is currently under consideration for publication elsewhere. This includes symposia, transactions, books, articles published by invitation, and preliminary publications of any kind except an abstract of 400 words or fewer.

Style and Format

Manuscripts should be double-spaced with 3-cm margins on all sides of the page, in Times New Roman font. Every page of the manuscript, including the title page, references, tables, etc., should be numbered. All copies of the manuscript should also have line numbers starting with 1 on each consecutive page.

Symbols, Units and Abbreviations

In general, the journal follows the conventions of Scientific Style and Format, The CSE Manual for Authors, Editors, and Publishers, Council of Science Editors, Reston, VA, USA (7th ed.). If symbols such as ×, μ, η, or ν are used, they should be added using the Symbols menu of Word. Degree symbols (°) must be used from the Symbol menu, not superscripted letter o or number 0. Multiplication symbols must be used (×), not the letter x. Spaces must be inserted between numbers and units (e.g., 3 kg) and between numbers and mathematical symbols (+, –, ×, =, <, >), but not between numbers and percent symbols (e.g., 45%). Please use SI units. All abbreviations and acronyms should be defined at first mention. Latin terms such as et al., in vitro, or in situ should not be italicized.

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Research articles should be divided into the following sections. Principal sections should be Introduction, Materials and Methods, Results, Discussion, Acknowledgements and References sections. Please see below for information about other types of manuscripts.

Title and Contact Information

The first page should contain the full title in sentence case, the full names (last names fully capitalized) and affiliations (in English) of all authors (University, Faculty, Department, City, Country), and the contact address and e-mail for the clearly identified corresponding author.

Abstract

An informative abstract of not more than 250 words must accompany each manuscript. The abstract must be structured to include the study's background, materials and methods, results, and conclusions and key words under 5 separate headings. Abstracts of review articles should be a brief overview of the main points from the review.

Keywords

Please provide at least 3 key words or phrases to enable retrieval and indexing. Acronyms should be avoided.

Always try to use terms from the Medical Subjects Headings (MeSH) list from PubMed https://www.ncbi.nlm.nih.gov/pubmed.

Introduction

This should argue the case for your study, outlining only essential background, and should not include the findings or the conclusions. It should not be a review of the subject area, but should finish with a clear statement of the question being addressed.

Materials and Methods

Explain clearly but concisely your clinical, technical, or experimental procedures. Previously published papers related to the methods should be cited with appropriate references. Brand names and company locations should be supplied for all mentioned equipment, instruments, chemicals, etc.

Results

Findings must be described without comment. The same data or information given in a Table must not be repeated in a Figure and vice versa. It is not acceptable to repeat extensively the numbers from Tables in the text or to give lengthy explanations of Tables or Figures.

Discussion

Statements from the Introduction and Results sections should not be repeated here. The final paragraph should highlight the main conclusions of the study. Names of funding organizations should be written in full.

References

In the text, references should be identified using numbers in square brackets in which they appear consecutively. The titles of journals should be abbreviated according to the style used in Index Medicus. Ageneral guide limit the number of references to 25 for original articles, to 6 for case reports and to 85 for reviews. For articles with 1 to 6 authors, list all authors. For articles more than 6 authors, list the first 6 authors followed by "et al.". Do not use individual sets of parentheses for citation numbers that appear together, e.g., [2,3,5-9], not [2],[3],[5]–[9]. For other styles of publication or Internet articles, see http:// www. nlm.nih.gov/ bsd/ uniform_requirements.html References should be formatted as follows (please note the punctuation and capitalization)

Journal titles should be abbreviated according to ISI Web of Science abbreviations. Authors are solely responsible for the accuracy and completeness of references.

Articles in Journals

Özpolat B, Gürpınar ÖA, Ayva EŞ, Gazyağcı S, Niyaz M. The effect of Basic Fibroblast Growth Factor and adipose tissue derived mesenchymal stem cells on wound healing, epithelization and angiogenesis in a tracheal resection and end to end anastomosis rat model. Turk Gogus Kalp Dama 2013; 21: 1010-9.

For other styles of publication or Internet articles, see http:// www.nlm.nih.gov/bsd/uniform_requirements.html

Tables and Figures

All illustrations (photographs, drawings, graphs, etc.), not including tables, must be labeled "Figure." Figures must be submitted both in the manuscript and as separate files.

All tables and figures must have a caption and/or legend and be numbered (e.g., Table 1, Figure 2), unless there is only one table or figure, in which case it should be labeled "Table" or "Figure" with no numbering. Captions must be written in sentence case (e.g., Macroscopic appearance of the samples.). The font used in the figures should be Times New Roman. If symbols such as ×, μ, η, or ν are used, they should be added using the Symbols menu of Word.

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Charts must be prepared in 2 dimensions unless required by the data used. Charts unnecessarily prepared in 3 dimensions are not accepted.

Figures that are charts, diagrams, or drawings must be submitted in a modifiable format, i.e. our graphics personnel should be able to modify them. Therefore, if the program with which the figure is drawn has a "save as" option, it must be saved as *.ai or *.pdf. If the "save as" option does not include these extensions, the figure must be copied and pasted into a blank Microsoft Word document as an editable object. It must not be pasted as an image file (tiff, jpeg, or eps) unless it is a photograph.

Tables and figures, including caption, title, column heads, and footnotes, must not exceed 16×20 cm and should be no smaller than 8 cm in width. For all tables, please use Word's "Create Table" feature, with no tabbed text or tables created with spaces and drawn lines. Please do not duplicate information that is already presented in the figures.

Tables must be clearly typed, each on a separate sheet, and double-spaced. Tables may be continued on another sheet if necessary, but the dimensions stated above still apply.

Instruction to Reviewers

The Current Thoracic Surgery is a current periodical, peer-reviewed and open access official e- journal of the Turkish Society of Thoracic Surgery which its funded and published three times annually. In April, August and December.

The language of the journal is English.

The Current Thoracic Surgery is dedicated to publishing clinical research, clinical analysis, laboratory and experimental studies, editorials, invited current reviews, case reports, interesting images and "How to Do It" papers.

The journal is based on independent and unbiased double-blinded peer-reviewed principles. Only unpublished papers that are not under review for publication elsewhere can be submitted. Current Thoracic Surgery does not accept multiple submission and duplicate submission even though the previous one was published in a different language. The authors are responsible for the scientific content of the material to be published. The Current Thoracic Surgery reserves the right to request any research materials on which the paper is based.

The Current Thoracic Surgery encourages and enables academicians, researchers, specialists to publish their valuable research in branches of general thoracic surgery, thoracic disease and thoracic surgery anesthesia. The primary aim of the journal is to publish original articles with high scientific and ethical quality and serve as a good example of medical publications in the World.

The Editorial Board of the Current Thoracic Surgery and the Publisher adheres to the principles of the International Council of Medical Journal Editors (ICMJE), the World Association of Medical Editors (WAME), the Council of Science Editors (CSE), the Committee on Publication Ethics (COPE), the US National Library of Medicine (NLM), the World Medical Association (WMA), the US Office of Research Integrity (ORI), the European Association of Science Editors (EASE), and the International Society of Managing and Technical Editors (ISMTE).

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All articles submitted for publication are strictly reviewed for their

originality,

methodology,

importance,

quality,

ethical nature and,

suitability for the journal

The Current Thoracic Surgery uses a well-constructed scheme for the evaluation process.

The overall rejection rate of the Current Thoracic Surgery is 29%.

The average time during which the preliminary assessment of manuscripts is conducted is 4 days.

The average time during which the reviews of manuscripts are conducted is 41 days.

The average time in which the article is accepted for publication is 59 days.

The entire submission process for a manuscript is completed online through the self-explanatory online submission system.. The reviewers can reach their personal pages from the same address with their own passwords.

Manuscripts that comply with the main rules of the journal are sent to at least two external reviewers, and the reviewers are asked for their opinion about the suitability of the paper for publication. The reviewed manuscripts are then re-reviewed by the Editor in Chief and the Editorial Board and a decision of rejection or acceptance is shaped.

If the reviewers have any **potential competing interests**, they must notify the editor before agreeing to review a submission.

The Current Thoracic Surgery is committed to the highest standards of **research and publication ethics**. Editors will act in accordance with the relevant international rules of publication ethics (i.e., COPE guidelines, ICMJE Recommendations, CSE White Paper on Publication Ethics, CSE White Paper on Publication Ethics, WAME resources, WMA policies and ORI) if any ethical misconduct is suspected. The Editorial Board of the Current Thoracic Surgery encourages reviewers to comment on possible research or publication misconduct such as unethical research design, duplication, plagiarism, etc.

Plagiarism is a serious problem and the most common ethical issue afflicting medical writing. Current Thoracic Surgery does not allow any form of plagiarism. In accordance with our journal policy, submitted manuscripts are screened with plagiarism software to detect instances of overlapping and similar text (iThenticate and others) at least two times (during the evaluation process and after acceptance). If the reviewers have any suspect, the editors can provide them information obtained by plagiarism screening tools.

An **approval of research protocols by an ethics committee** in accordance with international agreements ("WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects (last updated: October 2013, Fortaleza, Brazil)", "Guide for the care and use of laboratory ani-

mals (8th edition, 2011)" and/or "International Guiding Principles for Biomedical Research Involving Animals (2012)" is required for all research studies. If the submitted manuscript does not include ethics committee approval, it will be reviewed according to COPE's guideline (Guidance for Editors: Research, Audit and Service Evaluations). If the study should have ethical approval, authors will be asked to provide ethical approval. If they cannot provide ethical approval, their manuscript will be rejected and also their institutions and when needed, the related bodies in their country will be informed that such studies must have ethics committee approval. If the study does not need ethics committee approval after the editorial board's review, the authors will be asked to provide an ethics committee approval or a document given by a related independent committee that indicates the study does not need ethics committee approval according to the research integrity rules in their country. If the authors provide either an approval or a document showing that ethics approval is not needed, the review process will continue. If the authors cannot provide either documents, the manuscript will be rejected. For articles concerning experimental research on humans, a statement should be included that shows informed consent of patients and volunteers was obtained following a detailed explanation of the procedures that they may undergo.

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Our reviewers are expected to check that the art icles comply with the SAGER guidelines and encourage authors to do so. Authors should use the terms sex (biological attribute) and gender (shaped by social and cultural circumstances) carefully in order to avoid confusing both terms. Article titles and/or abstracts should indicate clearly what sex(es) the study applies to. Authors should also describe in the background, whether sex and/or gender differences may be expected; report how sex and/or gender were accounted for in the design of the study; provide disaggregated data by sex and/or gender, where appropriate; and discuss respective results. If a sex and/or gender analysis was not conducted, the rationale should be given in the discussion.

The Current Thoracic Surgery uses bibliographic databases and also accepts authors' suggestions to find new reviewers. The journal thanks to the reviewers and publishes the reviewer list every year in the last issue.

Besides the rutine questions given at the reviewers' comment page, the reviewers can also use the questions below, when reviewing the manuscripts:

1. Please do state if any conflict(s) of interest is present to review this manuscript.

2. Do you suspect any research or publication misconduct?

3. Does the manuscript contain significant information to justify publication?

4. Is the title of the article appropriate?

5. Does the abstract clearly and accurately describe the content of the article?

6. Is the problem significantly and concisely stated?

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8. Is the results section clear and satisfactory?

9. Are the interpretations and conclusions justified by the results?

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12. Are the figure/table lagends satisfactory?

13. Is it necessary to shorten/elongate the article sections?

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